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REVISION OF THE LICHENS OF THE NETHERLANDS

I. PARMELIACEAE

by

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(Pre-issued separately on 19. XI. 1947).

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INTRODUCTION.

1. Aim of the work.

Up to now there has been no modern flora of the Netherlands' lichens. In fact, the only lichen flora ever written in Holland (by H. C. van Hall) dates back as far as 1840. Anybody wishing to become acquainted with the native lichens has to use foreign works. This is, of course, a fact which in itself is not objectionable, but, whereas already before the war it was quite a problem for a private person to collect the most important works out of the multitude of the widely diffused literature, under the present conditions this is entirely out of the question. So much the more is there a reason for attempting to write a Dutch treatise. It may, therefore, cause some surprise that this work has not been written in Dutch, but this is due to the fact that that language is not generally known abroad. It is commonplace to state that progress in science is impossible without international intercourse, and I don't think that it can be denied that lichenology in the Netherlands is badly in need of some foreign contact! On the other hand, I do hope that, because of its being written in a universal language, the present work will contribute to a better knowledge of the geographical distribution of the lichens.

2. Distribution of the lichens.

For the sake of the Dutch student who is also interested in the distribution of the lichens outside the Netherlands, in broad outline the occurrence in Europe has been added to every species. I have restricted myself to this continent, since of a great number of species the data at my service concerning the extra-European distribution are too few or too uncertain. But even of the European countries I have no data at all from Latvia, whereas only very little and mostly old-dated literature is known from Albania, Great Britain, Greece, Luxemburg, Spain, and the U. S. S. R. (the republic Lithuania inclusive). The data of the distribution have not been based on an investigation of the material, as the Rijksherbarium has not the disposal of such a detailed collection, but have exclusively been drawn from literature. If there existed a modern treatise dealing with a particular country, I have entirely relied upon that work. In other cases, I have gone through the most important papers without aiming at completeness; the older papers, for instance, have as a rule not been considered in this respect. The references concerning the distribution have been inserted at the end of this paper, p. 188.

3. The taxa subordinate to the species.

In few groups of plants the number of varieties and forms described is as vast as it is in lichens. It is true that several authors have been so prodigal in creating new varieties that a tangle rather than a surveyable system was the result. On the other hand, there are others who, mindful of this deterrent, pay little attention to or even neglect the significance of the variability. I shall try to take an intermediate course between both views.

There are two ways in dealing with the varieties and forms of a species.

In the first and, at least in lichenology, most followed one, it is the type specimen of the species which occupies a predominant place both in attitude of mind and in description. The "specific" description is an extensive and detailed type description really, and, likewise, the varietal descriptions are type diagnoses of lower rank.

In the other method, the species is split up into varieties (and forms); the type does not dominate any longer, having the same rank as any variety. Whether the type subdivision (i. e. the taxon including the type) should be called "var. *typica*" or another name, will be discussed further on. The specific description is, and by continuous emendation remains, so wide as to include all varieties, whereas in their turn the varietal descriptions comprise all forms, including "f. *typica*".

Though the pros and cons of both methods have already been discussed by Lanjouw (in Rec. Trav. Bot. Néerland., vol. 29, 1932, p. 36—46), I should like to return to this subject, since I have arrived at a different view.

It is true that in following the first-named method, the species may be sharply discriminated one from another, whereas the "specific" description remains unaltered however many new varieties may be found afterwards. A serious objection, however, is the inconsistency of the subdivision of the species. If a family is split up into genera, and a genus into species, one may logically expect the species to be entirely subdivided into its varieties (and forms). Why should the type subdivision not have a name of its own? Some adherents to the method under discussion have felt right enough the need to designate plants, which do not differ from the type specimen, by a special name in order to mark them from the varieties, particularly if a polymorphous species is concerned. Now, my objection is that they have done so by using such terms as "planta typica, tipo, the type, typical form, the species, le type, forme typique, l'espèce, Typus, typische Form, Normalform, Grundform, Hauptform, Haupttypus, Hauptart, Stammform". May not one, in view of these instances, expect a scientific and more uniform term in taxonomy? And how inconsistent is this namegiving, for if the type of the species is designated by one of these names, then why not assume a "Normalform" or a "forme typique" for the type of the variety? Besides, a good deal of the names mentioned above strongly convey the impression either that the type of the species essentially occupies a central place, around which the varieties are subordinately arranged, or that it is the "normal" variety (form), whereas the other are derived ones. Why should the type be so strongly emphasised, why should it be considered normal, what is normal about the type, and what characters entitle the other varieties to be called "derived"? The real conditions may be entirely different. Within the "Formenkreis" of the entire species, the type of the species, whose only special position is due to the fact that it has been discovered first, may very well be an excentric fraction, having more "derived" characters than any other variety. It is quite possible that this type (or the group of closely related forms including the type), being adapted to a more extreme environment, has a smaller area than any variety of the same species. Finally, isn't it rather superfluous to point out that other names such as "the species", "Hauptart", are positively wrong? The type specimen is the starting-point, but it is inadmissable to go so far as to identify plants of its affinity with the whole species.

By the second method, it may in some cases be difficult to delimit certain species, as the originally simple image of the type may become blurred by the superimposed images of the varieties. The specific description, moreover, has to be emendated every time a variety is added or severed. I fully admit that it is a somewhat cumbersome way to designate specimens with a quaternary name, even a plant of the affinity of the type, viz. *Parmelia cetrarioides* var. *typica* f. *eu-typica*. On the other hand, the method is taxonomically correct. The species is conceived to be a unit, composed of minor taxa which between them are equivalent, and is not wrenched from its context by the preponderance of the type over the varities. On reading the specific description, one is immediately and fully informed about the variability of the species concerned.

These considerations have made me follow the second method, in spite of the objections stated above, and — a point which made me hesitate a long time — in spite of the nomenclatorial changes which would necessarily be entailed.

In the foregoing there has been some talk of "var. *typica*" as the designation of the type subdivision. It will be observed — perhaps not without some surprise — that this subdivisional name has not been used in the present paper. The reason is that, in accordance with Art. 16 of the International Rules of Botanical Nomenclature, I have always looked for the earliest epithet for "var. *typica*". If this proves to be homonymous with the specific epithet, there is no objection whatever to accept it. In anticipation of the validation of the amendment to Recommendation XXXV proposed by Sprague (in Kew Bull., 1939, no. 7, p. 324), I fully agree with this author's view, viz. that the repitition of the specific epithet is preferable to the use of such terms as "*typicus*", "*genuinus*", etc. Only in the forms I have added the prefix "*eu*" in order to mark the difference from the varietal epithet and to avoid monotony.

In agreement with the Editor of "Blumea" all epithets of species and of groups smaller than the species have been printed with small initial letter.

4. Measuring and chemicals.

All descriptions and measures in the present paper have been based on my own observations, unless stated otherwise. For the identification of the lichens I enjoyed the privilege to use the well-stocked collection of exsiccata in possession of the Rijksherbarium, as well as the material sent on loan by the late monographer J. Hillmann. I gratefully remember his help in revising a great number of my determinations.

Material for microscopical investigation has been placed in a slit in a piece of elder-pith, and dissections, after having been made off-hand, were studied in an aqueous medium. The reagents used are:

K (= KOH),	a strong solution of potassium hydrate, indefinitely tenable if preserved in a bottle with rubber stopper.
C (= $Ca(OCl)_2$),	a 1:1 solution in distilled water, tenable for many weeks in a glass-stoppered bottle; its activeness, however, need continual checking on a species of wellknown reaction before use of the reagent.
KC,	denotes the quickly consecutive application of a drop of K and a drop of C (not in reversed order).
J (= JKJ),	indefinitely tenable in a brown, glass-stoppered bottle.
N (= HNO_3),	strongly concentrated nitric acid.
Pd (= $C_6H_4(NH_2)_2$),	a solution of paraphenylenediamin in alcohol 96 %, oxydised and unfit for use after a few hours; to be made by dipping a moistened glass rod in the bottle containing the Pd-crystals and dissolving them in ½ cc alcohol or less. Pd-crystals are sensitive to light, so that the stock bottle should be kept wrapped up in black paper.

The chemicals are applied by dipping a pointed rod in the liquid and touching the thallus at the required spot.

5. Herbaria.

For the revision of the Dutch material I have made use of a number of herbaria which in this paper have been abbreviated as follows:

GRO,	Groningen, Botanisch Laboratorium der Rijksuniversiteit, Afd. Plantensystematiek.
Koopm,	private herbarium owned by Mr and Mrs Koopmans, Apeldoorn.
L,	Leiden, Rijksherbarium.
Maastr,	Maastricht, Natuurhistorisch Museum.
Midbg,	private herbarium of the secondary school at Middelburg.
NBV,	herbarium of the Koninklijke Nederlandsche Botanische Vereeniging, preserved in the Rijksherbarium.
Nga,	former private herbarium owned by E. T. Nannenga, but destroyed during the war.
TA,	herbarium of Tresling, now in possession of the secondary school at Ter Apel.

U,	Utrecht, Botanisch Museum en Herbarium.
VDWijk,	private herbarium owned by Prof. Dr R. van der Wijk, Groningen.
VS,	private herbarium owned by Ir J. L. van Soest, The Hague.
Wask,	private herbarium owned by Prof. Dr E. C. Wassink, Wageningen.
Wasr,	private herbarium owned by Dr J. Wasscher, Aalsmeer.

As far as mentioned in his list (in Chron. Bot., vol. 5, 1939, p. 142—150), the abbreviations used here are in keeping with those proposed by Lanjouw.

GENERAL PART.

CHAPTER I.

SURVEY OF THE HISTORICAL DEVELOPMENT OF LICHENOLOGY IN THE NETHERLANDS.

The historical development of lichen systematics, and of any other part of systematic botany, is reflected both by the collections and by the publications which have been delegated to us. In fact, the latter are unimaginable without the former, and whereas the number of both steadily grew, as they still do nowadays, other branches of science gradually developed, joining in to establish the large and interlaced complex which lichenology is in recent times. Almost every country in Europe some time and somehow participated in the cultivation of this science, and interchange of thoughts, if not always materialised, was greatly facilitated by the fact that the majority of the publications were written in German, French or English. Amidst these countries, the Netherlands stood aloof, not because there were no lichens, neither because of the collectors' inactivity, but because the florists who did collect lichens were no lichenologists, and their publications, with a very few exceptions, were written in Dutch. More and more the lichenology in this country fell behind, and it is no exaggeration to state that in this respect Holland resembles a forgotten island. How unjust it would be, however, to leave in oblivion the earlier florists and their work. The object of the present survey, therefore, is to picture the lichenology in the Netherlands, its growth, its one time prosperity, and its recent standstill.

1. Collections.

If we may, first of all, call the attention to the collections, it appears that lichens are represented in the Herbaria of Groningen, Leiden, and Utrecht. Among them, the Leiden collection of indigenous lichens is by far the largest one, containing a 5000 odd numbers (of course, the foreign lichens are left out of consideration here); besides, in the Rijksherbarium (National Herbarium) the collection of the "Koninklijke Nederlandsche Botanische Vereeniging" (Royal Netherlands' Botanical Society) is incorporated, which almost equals that of the Rijksherbarium (4400 numbers). As will be shown later, it was by the pushing power of the first president of the said Society, R. B. van den Bosch, that collections were made in various parts of the country. In the course of time they came into the possession of the Botanical Society either by grant or by purchase. The extent of its herbarium may be indicated by merely enumerating the more prominent florists, such as Th. H. A. J. Abeleven, S. E. Acker Stratingh, R. Bondam, R. B. van den Bosch, L. H. Buse, H. D. Gildemeester Buse, H. C. van Hall, D. Lako, C. A. J. A. Oudemans, C. M. van der Sande Lacoste, Fr. L. Splitgerber, W. G. Top, and J. Wttewaal. When, in addition, it is stated that most collecting was done in a period when the lichen flora of Holland was incomparably richer than the present one, this will suffice to show the importance of this herbarium.

Beside these herbaria, mention should be made of smaller collections which are either preserved in local musea, or owned by private persons. To the former belong the collections of J. L. Franquinet ("Natuurhistorisch Museum" at Maastricht), G. van Hennekeler (secondary school at Middelburg), and Tresling (secondary school at Ter Apel); to the latter those of Groot & van Soest (owned by J. L. van Soest), Mr and Mrs A. N. Koopmans—D. Forstmann, E. T. Nannenga (collection destroyed during the war), Smelt (owned by R. van der Wijk), J. Wasscher, and E. C. Wassink.

The oldest collection known extant in the Rijksherbarium is that of H. Boerhaave who lived from 1668 to 1738. It doubtless contains indigenous material, but the great number of species which could not possibly have grown in Holland clearly proves that many specimens have also been obtained from abroad. As no localities were mentioned — the usual trouble with collections of those times — Boerhaave's herbarium is of little value other than historical. Exact dates of collecting are unknown either.

The next record of lichens preserved is, as far as I could trace, no sooner than roundabout 1835 when herbaria were started, amongst others, by Buse and Van Hall. From that time the number of herbaria increased by leaps and bounds, to decrease again just as quickly from the end of the nineteenth century onward. The twentieth century may be roughly divided into one period before and another after 1930. In the former period collections were made by C. Brakman, W. P. ten Kate, D. Lako, J. H. Wakker (all owned by the Rijksherbarium), and by Smelt (in the possession of R. van der Wijk), none of whom are alive to-day. Collectors to be mentioned in the period after 1930 are E. Agsteribbe, C. Brakman (a relative of the afore-mentioned), E. T. Nannenga, S. J. van Ooststroom, J. L. van Soest, F. Stafleu, J. Wasscher, E. C. Wassink, V. Westhoff. and myself.

2. Literature.

Whereas it was shown in the foregoing that quite a number of collectors devoted their attention to lichens, we will see that still more people in some way contributed to the literature concerning the lichenology.

The sources from which the following data are drawn differ considerably, and their value must be appreciated accordingly. These data are almost exclusively relating to the floristics, whereas in the field of systematics and physiology a single paper only has appeared. The sources consulted for the present survey are catalogues of botanical gardens, local and general floras, check-lists, reports on excursions, lectures, and papers. Some general accounts which are not original, or popular papers on the nature, structure, and significance of the lichens have been omitted. Also herbals which occupy themselves only with the officinal use of lichens have not been enlisted. For the sake of surveyability, the matter is dealt with in chronological order.

a. *Seventeenth century.*

As far as I was able to trace, the first book to give a detailed indication of the locality of some lichen species is "Plantarum tum patriarum tum exoticarum in Walachriae, Zeelandiae insula, nascentium Synonymia" (1610) by C. Pilleterius (?—1658). Nothing else is known about this Pilleterius but that he was a Frenchman who had taken his M. D. degree at Montpellier, and was a physician at Middelburg. He had strongly felt the need that the knowledge of the officinal plants be more efficiently promoted, and tried to effectuate this purpose by writing a book in which he arranged in alphabetical order the plants he had found in the Island of Walcheren. Some of the plants were concisely described; every name was followed by the synonyms then known, as well as by the Greek, French, and Dutch names. In brief also the medicinal use was added.

The genus *Lichen* in this most remarkable book is represented by the species *L. maritimus alter* (p. 235) which, however, is no lichen, but the seaweed *Ulva lactuca*. True lichens may be found under the name *Muscus* (p. 274—275) which also includes a moss, viz. *Muscus terrestris primus* (= *Polytrichum commune*), and two *Lycopodiinae*, viz. *Muscus terrestris denticulatu* [= *Lycopodium helveticum* L. = *Selaginella helvetica* (L.) Link¹)] and *Muscus terrestris secundus* (= *Lycopodium clavatum*). With the aid of the wonderful "Historia Muscorum" (1741) by Dillenius, of Linnaeus' "Species Plantarum", and of Zahlbruckner's "Catalogus Lichenum Universalis", the remaining species, except one, may be identified as *Cladonia pyxidata, Cl. rangiferina, Lobaria pulmonaria, Usnea florida,* and *U. plicata.* Now, in connection with these names, the following points should be borne in mind. As long as there is no herbarium material to serve as a proof, nothing will guarantee that the naturalists of earlier centuries who naturally had only scanty literature at their disposal did actually identify their plants rightly. It is true that certain phrase-names have been proved to be synonymous with certain Linnean names, but it is not at all sure that a phrase-name has always been applied to the same species. Nor is it established that under all circumstances a Linnean name really refers to the species as conceived nowadays. Since many Linnean species have later on been split up into a number of smaller species on account of minor differences which escaped the attention of the early authors, it is impossible to decide merely from the literature what exactly was meant.

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¹) It may be observed that in historical times this species could not possibly have occurred in Holland. In Europe it is limited to subalpine regions, see Braun, Selaginellae Hortenses in "Index Semin. Hort. Bot. Berol. Appendix", 1857, p. 13.

To what results it may lead when we would go by a Linnean name only, is well illustrated by the case of *Cladonia rangiferina* which Pilleterius should have collected in the Island of Walcheren. The genuine *rangiferina* is represented in none of the Dutch collections, and I am quite certain that this species is not indigenous to the flora of Holland. *Cladonia rangiferina* belongs to the small subgenus *Cladina* which comprises five more closely related species, four of which being more or less common in Holland; it is reasonable, therefore, to assume that Pilleterius had one of these on hand, though we will probably never know which one. A similar case is met with in his *Cl. pyxidata* and *Usnea plicata* (sensu Motyka, nec auct.), neither of which are known from the Netherlands, whereas related species did occur, and still do.

Apart from a great many plants, vegetable and animal products, as well as other things of interest only with respect to their officinal use, we may find a catalogue of the Groningen Hortus in "Hortus et Universae Materiae Medicae Gazophylacium" (1646) by the botanist and medical man H. Munting (1583—1658). In 1642 he was appointed a professor at the Groningen University, and simultaneously charged with the directorate of the botanical garden. Four years later he published the above-mentioned index on cultivated and wild plants which he had collected from the "Groninger Ommelanden" (the environs of the town of Groningen), and the province of Drente. The one lichen mentioned was *Pulmonaria Muscus*, no doubt because of the curative action ascribed to this plant, rather than for the sake of the botanical significance. C. A. J. A. Oudemans, writing a paper on the historical development of the floristics in the Netherlands (in Ned. Kruidk. Arch., ser. 2, vol. 3, 1882, p. 325—399), questioned if Munting with this name might have meant *Lobaria pulmonaria*, arguing that some species of *Peltigera* would seem more likely. I for myself have no reason for doubting Munting's find.

In the same paper, Oudemans mentioned a somewhat later index which had appeared in 1662, and was written by H. Bruman (?—1679), principal of the Latin schools at Zwolle. This "Index stirpium" is an alphabetical list containing 423 plants which Bruman had found in the neighbourhood of Zwolle. His wanderings extended as far as Dedemsvaart, Wijhe, Vilsteren, and Zalk, all villages east of the river IJsel. Oudemans reproduced in his paper the complete check-list along with the Linnean names. As far as lichens are concerned, Bruman claims to have found *Cladonia pyxidata, Cl. rangiferina, Usnea barbata,* and *Lobaria pulmonaria*, the latter again doubted by Oudemans.

In 1668 the "Catalogus Plantarum Horti Academici Lugduno-Batavi" was issued, a work written by F. Schuyl (1619—1669) who in 1667 was appointed a praefectus of the Leiden Botanic Garden. After the catalogue proper which deals with the plants grown in the garden, we find at p. 72 the "Index plantarum quae in locis paludosis, pratensibus, arenosis & silvestribus prope Lugdunum in Batavis nascuntur". Surely it is a particular feature for ecological data of the locality to be mentioned in those days! Presumably, Schuyl enumerated plants which he had collected himself; among them we find at p. 78 *Muscus coralloeides* (= *Cladonia rangiferina*) and *Muscus terrestris pyxidatus* Lob. (= *Cl. pyxidata*).

Besides, Schuyl saw a good many more which he was not able to identify, uniting them as "Musci arborei, terrestris, palustris & maritimi species".

Some more lichens were enumerated in "Catalogus Plantarum indigenarum Hollandiae" (1683) by J. Commelijn. Commelijn (1629—1692) was a druggist and merchant at Amsterdam with a great interest in botany. When, in 1682, the municipal magistrates of Amsterdam decided on the establishment of a new Medicinal Garden in "de Plantage", Commelijn was to participate in the Committee charged with the supervision of the laying-out. Very soon, however, Commelijn took over the directorate, and within a few years he succeeded in making this garden one of the richest in the Europe of those days. Another example of Commelijn's interest in botany is his afore-said "Catalogus" which, according to the custom of his time, was written in Latin. The habitats, however, were given in Dutch. Apparently, Commelijn's "Hollandia" enclosed the provinces of Noord- and Zuid-Holland, as well as of Utrecht. At p. 74—76 there are under the name *Muscus* some 20 species, most of which I am, unfortunately, unable to identify. Some of them belong to the *Lycôpodiinae*, such as *Muscus denticulatus major* [= *Selaginella helvetica* (L.) Link] and *Muscus terrestris clavatus* (= *Lycopodium clavatum*). Finally, some of the names may, with the aid of Bauhin's "Pinax" and of Linnaeus' "Species Plantarum", be identified to belong to lichens, such as *Muscus arboreus usnea officinarum* (= *Usnea plicata*), *Muscus arboreus cum orbiculis* (= *Usnea florida*), *Muscus pulmonarius* (= *Lobaria pulmonaria*), and *Muscus amarus absinthyfolio* (= *Parmelia furfuracea*). From p. 63—64 in Commelijn's catalogue 7 species are enumerated under *Lichen* which are no lichens, but liverworts. *Lichen Petraeus latifolius*, for instance, is *Marchantia polymorpha* which then already was designated by the Dutch name "Steen-Leverkruyt". *Lichen Petraeus stellatus* and *L. P. umbellatus* which were mentioned in addition also prove to be synonymous with *Marchantia polymorpha*; by these names were meant those specimens which bear the female and male gametangiophores respectively. As regards the remaining specimens, I may refer to the paper by Jansen & Wachter entitled "Bryologiese notities 5" (in Ned. Kruidk. Arch., vol. 49, 1939, p. 244).

The last work on lichens to be mentioned in this century is "Horti Academici Lugduno-Batavi Catalogus" written by P. Hermann (1646—1695), and issued in 1687. Hermann was first of all physician to the East Indian Company at Ceylon where he collected plants for his famous "Herbarium Zeylanicum". In 1680 he became a professor of botany at Leiden. Apart from the plants cultivated in the Garden, Hermann also enlisted in his catalogue those growing wild, distinguishing them with an asterisk. At p. 369 and 370 there are 7 species of the genus *Lichen*, some of which, however, are hepatics. True lichens we may find, along with the mosses, under the genus *Muscus*. The most important items are *Muscus pyxioides terrestris* (= *Cladonia* spec.), *Muscus coralloides, sive cornutus montanus* (= *Cladonia rangiferina*), *Muscus arborea, usnea officinarum* (= *Usnea plicata*), *Muscus arboreus cum orbiculis* (= *Usnea florida*), *Muscus pulmonarius* (= *Lobaria pulmonaria*), *Muscus amarus, Absinthiifolio* (= *Parmelia furfuracea*), etc.

From the foregoing we may draw the following conclusions. Apparently, the number of lichens known in the 17th century was small. The species were designated by phrase-names, and, although identification with Linnean names is possible, there is no certainty as to which species were meant, especially as no material for comparison was left. Conspicuously enough, over and over again the same species were mentioned. It goes without saying that one is inclined to assume that those lichens were only sought after and described which were known to have officinal properties. It should in this connection be remembered that in the century under discussion the interest in plants was medicinal rather than botanical. It was the transitional period between the era of the herbal and that of the flora.

b. *Eighteenth century.*

From the hand of the famous physician H. Boerhaave (1668—1738) who in 1709 was appointed a professor of medicine and botany at Leiden, and, at the same time, was appointed superintendent of the Botanic Gardens, there exists an "Index alter" (1720), containing all plants cultivated in the Hortus Academicus. Species of the genera *Lichen* and *Muscus* were also mentioned. At the end of the latter genus Boerhaave wrote: "Hoc sunt species muscorum, quas variis anni temporibus legere licuit in locis urbi viciniis". Certainly this also holds for the lichens, as it would not have occurred to anybody to attempt their cultivation in the Gardens. A number of species of the genus *Lichen* were identified by the bryologist W. H. Wachter to be *Hepaticae* (in Ned. Kruidk. Arch., vol. 49, 1939, p. 246). Some of the remaining species may be identified to be lichens, such as *Peltigera canina, Lobaria pulmonaria, Ramalina fraxinea, R. calicaris,* and *Cladonia coccifera.*

During his stay in the Netherlands (1735—1738), C. Linnaeus (1707—1778), through the recommendation of Boerhaave, got an appointment to work up the valuable and precious plant collections of George Clifford who owned a beautiful country-seat, "Hartekamp", near Bennebroek, some miles south of Haarlem. Linnaeus published the work accomplished there in his "Hortus Cliffortianus" (1737). At page 477 a lichen was described with the words: "Lichen caule ramoso solido, foliis setaceis, receptaculis maximis orbiculatis peltatis, foliis radiatis". Fortunately, Linnaeus added the quotation Bauhin, Pinax, p. 361, so that it is possible, by way of this book and of Linn., "Species Plantarum", p. 1154, to identify the species as *Lichen plicatus* (= *Usnea plicata*), a species already previously known to him from Småland, Skåne, Germany, and England.

Boerhaave was succeeded by A. van Royen (1704—1779) who, in 1730, became a director of the Botanic Gardens at Leiden, and in 1732 a professor or medicine and botany. Van Royen, too, wrote a book on the plants cultivated in the Hortus Botanicus entitled "Florae Leydensis Prodromus" (1740), and including a number of lichens which he still considered to belong to the algae. As regards these lichens, it should be remarked that they are to be accepted with some reserve, since

Van Royen gives the impression of having simply copied those lichens, in his time believed to be indigenous to Holland, from foreign authors as Bauhin, Dillenius, Linnaeus, Vaillant, and others. Actually, "*Lichen foliis oblongis laciniatis, marginibus conniventibus ciliatis*" (= *Cetraria islandica*) proved to be indigenous, as it still does to-day, but *Umbilicaria deusta* (15. *Lichen folio orbiculato peltato, margine fere integro, undique glaber*) must have been much rarer. *Parmelia omphalodes* (16. *Lichen foliis planis acute laciniatis aeruginoso-albidis*), however, is a mountainous species which could never have been found in the lowland. Which species Van Royen had on hand we will probably never know, though the lichens of his collection are still present in the Rijksherbarium. Unfortunately, however, they are inserted under the Linnean names, the labels with the original phrase-names having apparently got lost, whereas localities are wanting.

Up to this time, all books dealing with lichens bore upon the western part of the Netherlands. In 1745 the first flora appeared from the central and eastern parts of the country, the "Flora Gelro-Zutphanica" by D. de Gorter (1717—1783) who in the same year was appointed an ordinary professor of medicine and botany at Harderwijk. David de Gorter succeeded his father, Johannes, who in 1735 had been the promotor of Linnaeus when the latter took his degree at the Harderwijk University. It was this famous Swedish biologist with whom young De Gorter undertook several botanical trips in the surroundings of his native town. De Gorter's flora was written in Latin, but reports about localities and habitats were in Dutch; it contained only 9 lichens about which nothing particular can be said. Afterwards De Gorter was to write some more floras.

In 1747 E. I. van Wachendorff (1703—1758) who since 1743 was a professor of medicine and chemistry at Utrecht published his "Horti Ultrajectini Index". This book is neither of importance to the knowledge of the contemporary state of lichenology, nor to that of the distribution of lichens in Holland, as it is a mere copy of Linnaeus' "Flora Suecica" without any statement of localities.

Not long thereafter, the "Flora Frisica" (1760) by D. Meese was published, the first flora to appear from a northern province. Meese (1723—1770), being employed as a curator of the gardens at the Franeker Athenaeum, was a self-made man who, along with the help of students, acquired the knowledge of Latin and Greek, and started the study of botany, among others, by translating Linnaeus' "Systema Naturae" and "Philosophia Botanica" in Dutch! He assiduously collected all kinds of wild plants which his native country produced, trying to identify them by means of Dillenius' "Historia Muscorum" and Linné's "Species Plantarum". In his booklet, the lichens are enumerated on p. 71—75, numbered 473—503. Meese thereby followed the style of "Species Plantarum". neither adopting, however, its subdivision of the genus *Lichen*, nor its binary nomenclature which may be considered a decided regression. The diagnoses are in Latin, and identical with those given by Linnaeus; the records of the localities are original, and occasionally commented if Meese found his data different from those in "Spec. Pl." This shows him to a certain degree to have been a critical investigator. In view of the books available to him, it is no wonder that Meese was sometimes mistaken as to some of his identifications. For instance, it may be considered out of the question that his *Lichen* no. 473 should represent Linnaeus' *Lichen geographicus*, a saxicolous species, as he wrote: "Deese vind men hier het fraaist op boomen van middelbare ouderdom, wiens bast nog ongeborsten en glad is" (This one may most beautifully be found on middle-aged trees whose bark is still uncracked and smooth). It is to be deplored that nothing seems to be left of Meese's collection; it could have given us an insight into the contemporary flora of a province which up to now is lichenologically the worst known part of the Netherlands.

Just like his previous flora, De Gorter's "Flora Belgica" (1767) was almost completely an exact copy of the "Species Plantarum" by Linnaeus, differing from it in that the subdivision of the genus *Lichen* was not adopted. The work was written in Latin, the records of the habitats in Dutch, but again copied from Linnaeus. Only in a few cases data were borrowed from Bauhin, Commelijn, and Meese. Out of the 80 lichens mentioned by Linnaeus, De Gorter enumerated 38 which, on the whole, were actually indigenous. Dubious ones are *Lichen* (= *Icmadophila*) *ericetorum* and *Lichen* (= *Ramalina*) *calicaris*. The former is a species which has been collected only twice, one find moreover being uncertain; the latter must always have been very rare, so confusion with related and much commoner species seems probable. As usual, the names *Lichen cocciferus, L. cornucopioides, L. pyxidatus* (= *Cladonia coccifera, Cl. coccifera* f. *cornucopioides, Cl. pyxidata*), and *L. plicatus* (= *Usnea plicata* auct.) were applied to the wrong species. Furthermore, De Gorter mentioned *Lichen Meesii* which Meese should have found in the province of Friesland, and designated by a phrase-name. Linnaeus disputed that it should be a lichen. It may be noticed that ordinary people apparently were unfamiliar with lichens, as they still are now, since in De Gorter's flora there are only two Dutch names, viz. "Longekruid" for *Lichen pulmonarius*, and "Boom-mosch" for *Lichen plicatus*. In the "Appendix" four more species were enumerated under the genus *Lichen*, three of wich I could not identify. The fourth one, *Lichen petraeus minimus, fructu orobi*, is the hepatic *Targionia hypophylla*, described in Linnaeus, "Spec. Pl.", vol. 2, 1753, p. 1136.

In 1779 there appeared from the hand of A. Loosjes Pzn. (1761—1818) the "Flora Harlemica" which is a Latin-written enumeration after the Linnean system with localities in Dutch. Part of the flora was borrowed from De Gorter's "Flora Belgica", as was stated in the preface, but partly also this work rested on own finds which were marked with an asterisk. Of the 4 lichens mentioned (p. 41), *Lichen pyxidatus* (= *Cladonia pyxidata*), was found by Loosjes himself in the dunes. The correctness of the determination can never be proved, since no herbarium material is left, but the find is improbable considering the experience of Sandstede's (in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 4/2, 1931) who holds var. *neglectum* (p. 404) as well as var. *pocillum* (p. 407) to be rare in the lowland of Northwest Germany. We may safely assume that, as regards the occurrence of *Cladoniae*, Holland would not look more promising than northern Germany.

Another flora by D. de Gorter, "Flora Zutphanica", was published in 1781, containing an enumeration of plants without descriptions. The value is questionable; it seems to be a copy of the flora by Meese, as may appear from the description of the habitats.

In the same year, 1781, D. de Gorter published his "Flora VII Provinciarum Belgii Foederati indigena". This book, as far as the lichens are concerned, is almost identical with his previous "Flora Belgica". Only some additional lichens were recorded, viz. *Lichen cornucopioides* (= *Cladonia coccifera* f. *cornucopioides*), *Lichen glaucus* (= *Cetraria glauca*), *Lichen islandicus* and *nivalis* (= *Cetraria islandica* and *nivalis*), and *Lichen pallescens* (= *Ochrolechia pallescens*). The record of *Lichen islandicus* originated from N. Meerburgh (1734—1814), then curator of the Leiden Hortus Botanicus, whose statement of the habitat ran like this: "... op den weg van Leiden naar Voorschoten aan een oude schutting" (along the road from Leiden to Voorschoten on an old fence). This points with certainty at something quite different. As regards *Lichen nivalis* which was also recorded by Meerburgh, it may be pointed out that this species, being an alpine *Cetraria* could never have been collected in the Netherlands. What exactly was meant by *Lichen pallescens* is uncertain, but I am sure I never met with *Ochrolechia pallescens* either in the field, or in any collection.

A book on a much higher level was "Plantarum Belgii Confoederati indigenarum Spicilegium" (1788) by S. J. van Geuns, with short diagnoses in Latin, and localities and habitats in Dutch. As stated in the preface, this "Spicilegium" was entirely planned after "Systema Vegetabilium" by Linnaeus, the descriptions being almost identical. When reading this book, it struck me that the name of Ehrhart was mentioned after some of the nearly 30 lichens, the explanation of which I found in the preface. Here it is told that this many-sided Swiss scholar (1742—1795), who lived in Hannover, made a botanical walking-tour through Holland in 1782. By the way, I may refer to J. Valckenier Suringar (in Ned. Kruidk. Arch., [1926] 1927, p. 117—149) who in vivid words described J. F. Ehrhart's encounters. On his way back to Germany, Ehrhart made the acquaintance of M. van Geuns, then professor at Harderwijk. As the latter was interested in the indigenous flora, more especially in the cryptogamic plants, both of them made some trips in the neighbourhood of Harderwijk, accompanied by Van Geuns Jr who conceived a growing admiration for Ehrhart. These trips particularly stimulated the love of plants in young Van Geuns, and it was then that his knowledge of Cryptogams was greatly enriched. On his return, Ehrhart gave a short account of the plants — lichens included — found in the Netherlands in the "Hannoverische Magazin" of 1783 (this was copied by Valckenier Suringar in his aforementioned paper). Many species, among them 21 lichens, had been found wanting in the floras by De Gorter, much to the disappointment of Van Geuns who wrote: "... plures a Gortero omissas plantas ...". Small wonder, if we bear in mind that Ehrhart, apart from being a well-known cryptogamist, was an all-round botanist, and a match even for Linnaeus. Since the original paper was barely known in Holland, Van Geuns borrowed from it Ehrhart's finds, adding the latter's name to the species new for the country. In some cases, Van Geuns went by the authority of Boerhaave, but for the rest the data were based on his own observations. Thanks to his good teacher, there are only few dubious cases or errors in this "Spicilegium", though some necessarily want correction. *Lichen centrifugus* (= *Parmelia centrifuga*), for instance, is a species which, except being distributed in the alpine regions of Central Europe, predominantly occurs in Fennoscandia; so it may be taken for granted that Ehrhart did not find *Parmelia centrifuga*, but the closely related *Parmelia conspersa* instead. *Lichen ochroleucus* (= *Haematomma coccineum* var. *ochroleucum*) and *Lichen aphthosus* (= *Peltigera aphthosa*), being mountainous species, may be excluded from the low country, whereas *Lichen pullus* (= *Parmelia prolixa* f. *dendritica*), entered on the authority of Boerhaave, is quite impossible either. Finally, about *Lichen perlatus*, a name which afterwards caused such an indescribable confusion, it is difficult to say anything definite. In later times a rather great quantity was collected of what was known as *Parmelia perlata*, but actually proved to be *Parmelia trichotera*, so it is probable, though by no means certain that Van Geuns had found that species.

Surveying the publications of this century, we may state that the interest in lichens had improved, and the number of lichens known greatly increased. The interest had shifted from medicinal use to pure botany. Gradually, the phrase-names were replaced by Linnean names. Also the uncritical practice of copying species from foreign authors gave way, albeit slowly, to the enumeration of own finds. The matter was, however, left there, for descriptions were still copied. From the great percentage of species, the occurrence of which must be considered unlikely, one is apt to conclude that the Dutch botanists had little or no personal contact with those abroad, trying to identify their finds with the aid of the few known works written by foreign systematists. Describing species by themselves was never even thought of. It is difficult to know how many species at the end of the 18th century were known, more so than at the end of the preceding. It is not like mere adding and subtracting, since in several cases there is no knowing what was meant by a certain name. In this century, too, almost any trace of a herbarium is lacking which could give an insight in the contemporary knowledge of the lichen flora. The only exception is Van Royen's herbarium, but as the species are being inserted under their binary names instead of the original phrase-names which presumably are lost, it is of little use.

c. *Nineteenth century.*

N. Mulder (1796—1867) took his doctor's degree in 1818 on the thesis "Elenchus Plantarum, quae prope urbem Leidam nascuntur". Like the majority of other authors who in some way or other had dealt with lichens, Mulder was no lichenologist; lichens were only mentioned for the sake of completeness. In 1822 Mulder was appointed a professor of botany, chemistry, and pharmacology at Franeker, and in 1841 a professor at the faculty of mathematical and physical sciences at Groningen. In his "Elenchus", adopting Acharius' "Synopsis Lichenum" (1814), Mulder gave to every species mentioned a Latin diagnose and a description of the habitat in Dutch, whereas in some cases the locality was also accurately recorded. In this work, too, some of the species need critical consideration. *Lecidea geographica* (= *Rhizocarpon geographicum*), for instance, being a lithophilous species, can never have been found on trees. *Parmelia stellaris* may refer to *Physcia stellaris*, as well as to *Ph. aipolia*, or even to other species. From herbarium material, it appears that *stellaris* was somewhat rare even in former times; the epithet, however, was applied to several other *Physciae*. Certainly, *Borrera* (= *Anaptychia*) *ciliaris* was recognised readily enough; it is still found in the neighbourhood of the town, though it is very rare to-day. If *Cetraria glauca* then occurred in the surroundings of Leiden, it does not nowadays. According to Mulder, *Sticta* (= *Lobaria*) *pulmonaria* would have occurred on trees along the canals (at Leiden), at Endegeest, Rijngeest, Warmond, and Wassenaar. This sounds unbelievable; on the one hand, to our notion, it is hardly possible for so conspicuous a plant to be mistaken for anything else, on the other, one might expect in a species, which appeared to be common, to find some evidence of it in the collections. Besides, the habitat, viz. trees along canals, seems very unlikely for a species which is known to be hygrophilous and silvicolous! *Cenomyce* (= *Cladonia*) *pyxidata, coccifera, fimbriata,* and *rangiferina* are probably misinterpreted for closely related species common to these regions. Furthermore, I think that the author, though writing *Ramalina calicaris,* meant some other species. For, *calicaris* has been too rare — witness the scanty material extant in the herbarium — for being described as "common on appletrees and willows at Leiden". Very interesting is the find of several species of *Usnea* (*florida, plicata, plicata* var. *hirta*) at Wassenaar, Endegeest, and Warmond. Surely enough, there were in those days and in those places extensive woods not yet mutilated by countless country-houses, as they are now, so that it may be taken for granted that *Usneae* did grow there. If only Mulder had left some material!

In the same year 1818 appeared the "Kruidkundig Handboek" by H. Schuurmans Stekhoven (1757—1839), chief-gardener at the Leiden Botanic Gardens. The second part, containing the Plantae Cryptogamicae, deals with the lichens (p. 76—131) after Sprengel's "Systema Vegetabilium", though the diagnoses are not literally copied. The description of the habitats is in Dutch. Schuurmans Stekhoven may have known a number of lichens, as we may gather from the few specimens left in the collection of the Botanical Society, yet his work does not look original. When, for instance, we read that *Lecidea geographica* (= *Rhizocarpon geographicum*) "menigvuldig groeit, op muren, en zeer fraai op de schors der boomen" (grows abundantly, on walls, and very beautifully on the bark of the trees), we suspect some relation with the statement Meese made in his "Flora Frisica". About *Lecidea* (= *Umbilicaria*) *pustulata* nothing more is stated than "groeit op steenen" (grows on stones); as this species is only known from two localities in the Netherlands, it is to be deplored that Schuurmans Stekhoven did not locate his finds. Localities of *Gyrophora* (= *Umbilicaria*) *deusta, pellita* (= *polyrrhiza*), and *spadochroa*

(= *spodochroa*) were not given either. The first-named species still occurs in the province of Drente, but the occurrence of the two others is very doubtful. What I have said elsewhere (p. 14) about *Baeomyces cocciferus, B. cornucopioides*, and *B. pyxidatus* (= *Cladonia coccifera, Cl. coccifera* f. *cornucopioides, Cl. pyxidata*) need not be repeated here. Furthermore, *Peltidea* (= *Peltigera*) *aphthosa* and *venosa* may be regarded erroneous determinations, as both of them are mountainous species.

An outstanding work rising above much which had thusfar appeared (as well as above much that was to appear) was the "Flora Belgii Septentrionalis" (1840) by H. C. van Hall (1801—1874). It is worth mentioning that Van Hall started as a physician who in 1823 had taken his M. D. degree at Utrecht on the thesis "De stethoscopiis in morbis pectoris usu". Later on, he directed his interest also to the plant world, and finally, in 1826, became a professor at Groningen University. In his flora which has a homonymous title in the Dutch part, and is entirely bilingual even up to the very specific epithets which, by the way, never grew popular, we find for the first time the Dutch equivalent "korstmos" of the scientific name "lichen". It is the first flora to have a key which leads to the genera! Van Hall adopted the classification used by Fries in "Lichenographia Europaea reformata" (1831), and he also borrowed most of the diagnoses. But from the particulars on locality and habitat, often treated at some length, it is sufficiently obvious that Van Hall was not a man to content himself with merely copying books. On the contrary, he drew upon the rich experience of long years of collecting. His material is preserved in the collections of the Rijksherbarium, of the Botanical Society, and of the Groningen University herbarium. Passing on to the species, the following ones may be mentioned as being of special interest. *Lichen articulatus* (= *Usnea articulata*) was a species not separately recognised by Van Hall, but regarded as a senile form of *U. barbata*. It gives us a slight insight into what we have lost, learning that *Usnea articulata* was a common species of the dunes. *Evernia* (= *Alectoria*) *jubata, Evernia divaricata, Ramalina pollinaria* (= *duriaei*), *Peltigera malacea, P. horizontalis, Sticta pulmonacea* (= *Lobaria pulmonaria*), *Parmelia tiliacea* (= *quercina*), *Umbilicaria pustulata*, several species of the genera *Collema* and *Calicum, Sphaerophoron coralloides* (= *Sphaerophorus globosus*), they are all as many examples of interesting species which to-day either have become extremely rare or extinct.

Three years after Van Hall's flora, the "Flora Rheno-Trajectina" (1843, reprinted in 1847) by P. M. E. Gevers Deynoot was published, a work not at all bad in itself, but somewhat falling short compared with the preceding flora. In the preface of this flora which was entirely written in Dutch, the author stated that his investigation would comprise the neighbourhood of the city of Utrecht up to a distance of two hours' walking. As boundaries he took the villages Zeist, Huis ter Heide, de Bilt, Maartensdijk, Westbroek, Maarssen, Vleuten, Harmelen, Jutphaas, Houten, and Bunnik. Descriptions are not given, the flora is nothing but a checklist with statements of habitats and of occasional localities. The book conveys the impression of reliability, though there are still such names as *Usnea barbata, Parmelia perlata, Cladonia pyxidata, Cl. cornucopioides,* *Cl. rangiferina, Ramalina calicaris, Parmelia stellaris.* The only species I should like to draw attention to is *Ramalina duriaei* which in former times was generally called *R. pollinaria*, as it was in Gevers Deynoot's flora. Whereas this species was a common appearance on trees in those days, it has practically disappeared in the present time.

The province of Zeeland possessed an enthusiastical florist in the person of R. B. van den Bosch (1810—1862) who was a physician at Goes. He extended his collecting trips to the Islands of Noord- and Zuid-Beveland, Walcheren, Schouwen, Tholen, and to Zealand-Flanders, but the majority of the lichens were collected in the Island of Zuid-Beveland where he lived. By the way, it may be noted that Van den Bosch sent some of his lichens to the authoritative German lichenologist G. W. Körber who incorporated them in his "Stammherbar". Though his principal work was the "Hymenophyllaceae Javanicae", Van den Bosch was greatly interested in lichens as well, witness his work "Lichenes Javanici" which, with the collaboration of J. F. C. Montagne, he had published in their "Sylloge generum specierumque Cryptogamarum" and in "Plantae Junghuhnianae". As a co-founder and enthusiastical president of the "Vereeniging voor de Flora van Nederland en zijn Overzeesche Bezittingen" (Society for the Flora of the Netherlands and their Overseas Properties, which in 1867 was renamed into "Nederlandsche Botanische Vereeniging"), Van den Bosch devoted himself to a flora of the Netherlands, persuading the members to collect as extensive a material as possible. A flora to be published by this Society, however, was a desire Van den Bosch should never live to see. Now at last, rather more than a hundred years after the foundation of the Society (August 15, 1845) a part of the "Flora Neerlandica" is about to appear! In preparation for the flora, Van den Bosch meanwhile published his "Enumeratio plantarum Zeelandiae Belgicae indigenarum", the volumes 3 and 4 of which included some data on lichens. In vol. 3, 1845, we find a check-list with the statements of habitats; localities were not given in detail, as to the opinion of the author the name of the island would do. Important finds were *Ramalina pollinaria* (= *duriaei*); *Parmelia Tiliacea* (= *quercina*), a species which has disappeared since; *Parmelia* (= *Anaptychia*) *ciliaris*, much rarer today; *Parmelia* (= *Physcia*) *stellaris*, very rare, if present at all; *Collema pulposum* and *nigrescens*, *Calicium trachelinum* and *phaeocephalum* (= *Calicium sphaerocephalum* and *Chaenotheca phaeocephala*) have never been found again. In volume 4, 1846, at p. 114 mention was made of *Parmelia Clementi* (= *Physcia astroidea*) a fine species which is more commonly distributed in southern Europe, and has never been found again in Holland.

For the first time in 1846, a short paper by F. J. J. van Hoven appeared in the periodical "Nederlandsch Kruidkundig Archief" where (p. 279) something is said about the lichens from the surroundings of 's Hertogenbosch. Apart from *Parmelia obscura*, a really obscure name which was applied to several *Physciae*, arousing much confusion, Van Hoven also mentioned *Lobaria pulmonaria* from a wood near Vught. This statement — which I have no reason to doubt — is an important one, as it proves that *Lobaria pulmonaria* apparently had a wider distribution in

Holland than may be concluded from the scanty herbarium material.

The same number of this journal contained an account of a tour made by the bryologist J. H. Molkenboer to a wood in the central part of the province of Gelderland. The paper was entitled "Schets der mos-vegetatie van het Beekbergerwoud" (An outline of the mossvegetation of the Beekbergen wood) (p. 260—272), and the one lichen observed was *Peltigera canina.*

The idea of drawing up a floristic inventory of a limited area gradually won ground. Such an inventory was the "Flora Noviomagensis" (1848) by P. M. E. Gevers Deynoot and Th. H. A. J. Abeleven, being a check-list of the plants collected around Nijmegen. The habitats and sometimes also the localities were mentioned. Remarkable lichens have not been found; the material is preserved in the herbarium of the Botanical Society.

In the same year, F. J. J. van Hoven (later on called Slingsby van Hoven) published his "Flora van 's Hertogenbosch", written in Dutch. The area investigated included the town of 's Hertogenbosch and, besides, Heusden, Engelen, Empel, Vught, Helvoirtsche heide. Some 20 lichens were enumerated without descriptions from p. 31—32. Comment on such species as *Usnea barbata, Cladonia rangiferina,* and *Cenomyce* (= *Cladonia*) *pyxidata* may be considered superfluous. The find of such a species as *Evernia* (= *Ramalina*) *calicaris* need not be considered unlikely beforehand, but as pointed out above, this *Ramalina* has always been very rare. Moreover, it appeared from the herbarium material that the epithet *calicaris* was usually applied to the common *R. farinacea.* Apart from *Lobaria pulmonaria* which was already mentioned in his paper two years back, a remarkable find in this flora is *Parmelia* (= *Anaptychia*) *ciliaris.*

R. Bondam and J. G. Top Jz. published in 1849 their "Flora Campensis" which, no more than most of the previous works, was a real flora because of the lack of descriptions. The habitats and occasionally a detailed locality were mentioned. The species are enumerated from p. 31—54, the material is preserved in the collections of both Botanical Society and Rijksherbarium. Nothing particular is to be said about these species. In the preface mention was made of this flora being a second edition; the first one published in 1845 is unknown to me.

At the annual assembly of the Botanical Society, August 17, 1849, C. M. van der Sande Lacoste read a paper which was subsequently published in the "Ned. Kruidk. Arch." (1851) under the title of "Flora lichenologica van Amsterdam". The area investigated included the near surroundings of the city, the dikes along "het IJ", the Zuiderzee, and the Haarlemmermeer. Notable finds were *Parmelia* (= *Anaptychia*) *ciliaris,* rare in this area to-day; *Usnea barbata* var. *hirta* (= *Usnea hirta*), gone lost; *Ramalina pollinaria* (= *duriaei*), disappeared; *Parmelia* (= *Physcia*) *astroidea,* lost; *Calicium subtile,* lost.

At the same meeting, Van der Sande Lacoste also showed a specimen of *Parmelia chrysophthalma* (= *Teloschistes chrysophthalmus*) which he had collected near the city of Utrecht. Van der Sande Lacoste (1815—1887) was a physician at Amsterdam, and being of independent means, he used his spare time to collect Phanerogams and Cryptogams which had already drawn his attention during his student days at Leiden and Utrecht. Feeling most attracted to the mosses, he made a bryological reputation with his "Synopsis Hepaticarum Javanicarum" (1854), and with the completion of the "Bryologica Javanica" which in 1855 was started by F. Dozy and J. H. Molkenboer. Beside the mosses, he evinced a keen interest in lichens, witness his large herbarium, but he never felt sufficiently at home in this group to publish anything more important than a check-list.

Another physician to occupy himself with botany was J. E. van der Trappen, being in practice at Naaldwijk. In 1852 he published his "Bijdrage tot de kennis aan Neêrland's Flora" (Contribution to the knowledge of the flora of the Netherlands) which the author stated to be a check-list of plants occurring in "het Westland". This is the south-western part of the province of Zuid-Holland, comprising the villages Loosduinen, Monster, Terheide, 's Gravenzande, Naaldwijk, de Lier, Wateringen, Hondsholredijk, and Poeldijk. At pages 13—14, the lichens were mentioned, the important ones among them being *Usnea barbata, Hagenia* (= *Anaptychia*) *ciliaris, Calycium hyperellum* and *trachelinum, Collema pulposum,* and var. *crispum* (= *C. crispum*), *Collema vespertilio,* and *C. atro-coeruleum* (= *Leptogium lichenoides*). To be sure, the *Usnea* species is not *barbata* sensu Motyka, but any *Usnea* from this part of Holland is of interest. None of the species enumerated here I have been able to find again. This might be explained by the fact that the lichens disappeared along with the trees on which they grew. The subsequent enormous development of greenhouses forbade the re-establishment of lichens other than the most hardy ones indifferent to human influences.

At the meeting of the Botanical Society from August 30—31, 1850, R. Bondam delivered a speech on the flora of Harderwijk and its surroundings by which was understood the region including Nunspeet, Hulshorst, a part of the "Leuvenumsche bosch", and the country-seat Essenburg. The great majority of the plants found were Phanerogams, the only lichens being *Collema nigrescens, Stereocaulon paschale,* and *Usnea hirta.*

The year 1853 was a great one for the lichenology in the Netherlands when that part of the "Prodromus Florae Batavae" was brought before the public containing the lichens compiled by R. B. van den Bosch. Certainly, this was not his ultimate object, as Van den Bosch still kept in mind a real flora, but it was surely an improvement eventually having at one's disposal a survey of what had thusfar become known. The difference from previous enumerations was that of all species mentioned in this "Prodromus", material was being preserved in the collections of the Botanical Society. For the identification of the lichens, Van den Bosch mainly used E. Fries' "Lichenographia Europaea reformata", Schaerer's "Enumeratio critica lichenum Europaeorum" and his "Lichenum Helveticorum Spicilegium", as well as this author's exsiccata.

The floristic inventory of Holland was more and more intensively taken in hand, and the results were published in books or in journals. Usually, however, the florists were phanerogamists who cared little for Cryptogams. If they had an eye for lichens at all, they collected the most conspicuous ones which in the low countries are not the rarest, but there it is. This, among others, is the case with S. P. Kros and J. J. Bruinsma who had visited the Island of Ameland. Kros gave in the "Ned. Kruidk. Arch." (1856) an account of this excursion which was entitled "Vegetatie van Ameland". The only lichens observed were *Peltigera canina, Evernia prunastri,* and *Cetraria* (= *Cornicularia*) *aculeata.*

In "Ned. Kruidk. Arch." of 1858 a report was entered on a speech made by L. H. Buse at the annual meeting, on the third of July 1857. Buse was a notable figure in the Society in that he united in himself the combination of a lawyer and a botanist, a combination which after him was actualised only once more. W. H. Wachter (in Ann. Bryol., vol. 10, 1937, p. 157) called him an eminent bryologist, but Buse did not neglect the other Cryptogams, and a great many specimens in the lichen collection of the Botanical Society are due to his activity. Buse at first collected in co-operation with H. D. Gildemeester Buse in the neighbourhood of Haarlem where he was born. He studied law at Utrecht, took his degree LL. D., and settled at Bennekom where he roamed the rich surroundings in company of Mrs Buse, a former Miss Koppiers. After his death, his heirs granted the whole of his herbarium, amounting to as many as 35.000 numbers, to the Rijksherbarium on the understanding that the native plants should be given to the Botanical Society. Among the foreign lichens there were numerous series of exsiccata.

The account of the speech by Buse, though being very short, gives a slight impression of the contemporary flora. It mentions, among others, *Evernia divaricata* which was found to grow on the ground between Bloemendaal and Heemskerk. This is a highly interesting find as *E. divaricata* has a largely mountainous distribution, moreover being usually associated with *Picea.* Confusion with the common *Evernia prunastri* is out of the question, the material being still present in the herbarium. Another particularity is the find of *Evernia jubata* var. *bicolor* (= *Alectoria jubata*) on boulders of the cairns in the province of Drente, and on a tree at Doorwerth. By the way, by a cairn (± a cromlech) is meant the group of boulders which in neolithic times constituted the enclosure proper of a grave within the earthen tumulus. I examined all of the 50 cairns in the provinces of Drente and Groningen, and made several forays in Buse's hunting-grounds, without being able to rediscover a single specimen of this *Alectoria.* The latest find, dating back to 1933, is from a wood near Hoogeveen in Drente. The third species enumerated by Buse was *Cetraria sepincola,* but that was probably a mistake. This species has never been collected in Holland, but its name was generally applied to the somewhat common *Cetraria chlorophylla.*

At the same meeting (1857), Van der Sande Lacoste gave an outline of the vegetation in the Island of Wieringen, largely dealing with the Phanerogams. The only lichens observed were *Ramalina calicaris* (presumably again *R. farinacea*) on trees, and *Verrucaria maura* on stones of the sea dikes.

In "Album der Natuur" (1863), a journal for the general public, a paper by Van Hall was issued, entitled "Zandgronden en zandverstuivingen in Nederland" (Sands and sanddrifts in the Netherlands). In this paper which is a mixture of regional description and travel story, of ecological observation and plant description, Van Hall mentioned some lichens characteristic for the bare sands and the heaths, among them *Cetraria* (= *Cornicularia*) *aculeata, Stereocaulon paschale,* and some *Cladoniae.*

Formerly, most of the florists were non-professional, as they still are to-day, and the surprising thing is that an appreciable percentage had a medical profession. It was a Delft physician, H. M. de Witt Hamer (1811—1895), who wrote the "Flora Delfensis" (1868). The material for this flora was collected in the surroundings of the town as far away as 1 to 2 hours' walking. The author made use of the data from Van Hall's "Flora Belgica Septentrionalis" and from the "Prodromus Florae Batavae". On p. 59—60 of this enumeration, De Witt Hamer mentioned 20 lichens, with statements of habitat and locality. Apart from such uncertainties as *Parmelia olivacea* and *Parmelia obscura* which may be interpreted in many ways, we may conclude that the Delft area has greatly impoverished in its lichen flora. *Ramalina farinacea* and *R. fraxinea, Parmelia* (= *Anaptychia*) *ciliaris,* and *Patellaria* (= *Caloplaca*) *aurantiaca* are now sought for in vain, whereas the other species are represented by poor remainders.

In connection with this impoverishment which, by the way, is menacing the entire arboricolous lichen vegetation, it may be allowed to make the following remarks. It is generally assumed that the lichen growth recedes exclusively by the action of factory-smoke, and the noxious gases of town and traffic. As far as Holland is concerned, however, also the gradual disappearance of the suitable substratum, viz. the old trees, is a factor of the utmost importance which should not be neglected. Far around the town of Delft, all old elms, the Dutch roadside trees par excellence, have long since disappeared, and along with them every trace of lichen growth.

In 1870 the posthumous work by F. Holkema, entitled "De plantengroei der Nederlandsche Noordzee-eilanden: Texel, Vlieland, Terschelling, Ameland, Schiermonnikoog, en Rottum", was given into light. The work was meant to be his thesis, but he died before it was finished. It was then taken over by his teacher and promotor H. C. van Hall. It not only contained an enumeration of all plants found in the said isles, but it is here that we meet with the first attempt at a sociological investigation. The plants out of every vegetation-type were divided into 4 groups according to their numerical abundance. The dominating plants got the figure 4, those which grew solitarily were designated by the figure 1. The intermediate cases were numbered 3 or 2. The mosses and lichens, however, could not be valued along these lines, as they differed from the Phanerogams by their appearance in mass, as well as by their individual smallness. The number of lichens enumerated by Holkema in his list is surprisingly small, and for the most part they are the large and conspicuous species, several of which are preserved in the collection of the Botanical Society. They do not include any notable find: the *Cladoniae* should be regarded with some reserve as far as no material for comparison is left. It is a pity that Holkema did not consider the lichen growth on the whale jaws which in great numbers were used as fences in the Isles of Vlieland, Terschelling, and Ameland. The German lichenologist H. Sandstede who published a contribution to the lichen flora of the East Frisian Islands (in Abh. naturwiss. Ver. Bremen, vol. 12, 1892, p. 173—177) drew the attention to the luxuriant lichen vegetation on whale bones, so a comparison between both vegetations might have been very interesting.

In "Ned. Kruidk. Arch." of 1870, Th. Sprée and L. H. Buse gave some additions to the cryptogamic flora of the Netherlands. From p. 313—317 the lichens were enumerated with the statement of their localities. Notable finds were *Ramalina pollinaria* (= *duriaei*), *Cetraria pinastri, Sticta scrobiculata* (= *Lobaria verrucosa*), *Sphyridium placophyllum* (= *Baeomyces placophyllus*), *Parmelia aspera,* and several species of *Calicium.* Comparing this enumeration with the present-day flora, it dawns upon us what losses we have suffered.

In imitation of the practice in use with the foreign botanists, C. A. J. A. Oudemans (1825—1907) also started the issue of a set of exsiccata. Though young Oudemans was greatly interested in botany, he went and studied medicine, presumably since he realised that the Holland of those days could not offer a reasonable living to a botanist, and considering the study of medicine nearest to his botanical ambitions. In his student days he had intimate connections with the bryologists F. Dozy and J. H. Molkenboer who were among the best teachers in the field of cryptogamic botany he could wish. Molkenboer, particularly, had a great influence on his scientific development. In 1848 Oudemans became a lecturer of botany and of "Materia medica et Historia naturalis" at the Medical School at Rotterdam, by the side of which, however, he remained a medical practitioner in order to increase his meager income. In 1859 he was appointed a professor of medicine and botany at the Amsterdam Athenaeum Illustre, and in 1877 a professor of botany and pharmacology at the same institute which by then was raised to the rank of a municipal University. Oudemans' name, by the way, is best known in connection with his mycological publications.

The entire set of exsiccata which were started in 1867 consisted of 12 parts of 50 numbers each, containing Phanerogams as well as Cryptogams. A reasoned catalogue was published in "Ned. Kruidk. Arch." of 1871. It contained no lichens new to Holland except a very interesting species, viz. *Psoroma crassum* (= *Lecanora crassa*) which Oudemans and Van der Sande Lacoste in 1869 had collected from the "St. Pietersberg", a calcareous hill near Maastricht in the southernmost part of Limburg. Most probably, this locality is in the meantime destroyed as a consequence of the exploitation for the sake of the production of the all important lime, but remainders of the species still seem to hold out elsewhere, as is shown by a recent find from the "Bemelerberg".

In the first part of "Ned. Kruidk. Arch." of 1872 there appeared the accounts of two excursions in the surroundings of Almelo, Albergen, and Vriezenveen, and near Delden and in a wood called "Twikkelerbosch". It had, under the influence of the papers on Cryptogams, grown into a custom to include into these accounts the lichens, too. So much the more striking is the incongruity that none of the participators thought it worth while collecting lichens. The only lichens observed during the first excursion were *Cladonia cornucopioides* and *Imbricaria olivacea* — by which some related species may have been meant —, whereas during the second *Anaptychia ciliaris* and *Imbricaria tiliacea* (= *Parmelia quercina*) were recorded. The last-named species, if rightly identified, is of particular interest, as it belongs to the steadily growing group of lichens labeled: disappeared.

In 1873 M. Treub took his Ph. D. degree at the Leiden University. Treub (1851—1910) started his splendid scientific career with his thesis on a most unusual subject: "Onderzoekingen over de Natuur der Lichenen" (Investigations on the nature of the lichens). The motive to these investigations was the great conflict which dominated the lichenological world of those times, the gist of which was: the pros or cons of the theory on the dualistic nature of the lichens (the De Bary-Schwenderer-theory). Treub who realised that culture experiments were necessary to settle the question whether the gonidia were algae or parts abstricted from the fungus hyphae, did not succeed in synthesising a thallus from the algal and fungous components. Yet, he was convinced that his results could not be explained but for accepting the dual nature of the lichens.

An important contribution to the flora of the dunal region was furnished by F. W. van Eeden who published his "Lijst der Planten die in de Nederlandsche Duinstreken gevonden zijn" in "Ned. Kruidk. Arch." of 1874. Van Eeden (1829—1901) was a director of the "Afdeeling Handelsmuseum van het Koloniaal Museum" (Department Commercial Museum of the Colonial Museum) at Haarlem. Apart from a great interest in the Suriname commercial products, and in the development of this region, botany was his favourite study. His enumeration must have been the result of a botanising activity of long years; it was copied in Journal of Botany, N. S., vol. 4, 1875, p. 142—154, for comparison with the flora of Norfolk, Suffolk, and Essex. Though Van Eeden stated that, for the arrangement of this list, he had made use of the works of several earlier authors, it is obvious that he had a thorough knowledge of the indigenous flora himself. His work is rather more than a mere check-list of species found in the Island of Texel, and from Callantsoog to the Hague. In various ways Van Eeden indicated whether the plants had been found inside or outside the dunal region proper, whether they grew in abundance or solitarily, whether they were characteristic for the dune flora, and so on. Lichens were mentioned from p. 433—436, and several of them were reported to be very common. Again we state notable differences from the present situation. *Usnea articulata,* a species which we already met with in Van Hall's work (p. 18), was still a common plant. *Patellaria scruposa* (= *Diploschistes scruposus*) may still be found, but at least in the dunes near Wassenaar it has become rare. *Leptogium atro-coeruleum* (= *lichenoides*) and *Placodium* (= *Lecanora*) *lentigera* have never been collected again. Most of the remaining crustaceous species enumerated by Van Eeden must be left out of consideration, as, for the time being, I am too little familiar with them.

How thoroughly Van Eeden had searched the coastal region, was shown by a "Supplement" published by H. M. de Witt Hamer in "Ned. Kruidk. Arch." of 1876. In this supplement also the "Haagsche Bosch" (The Hague wood) was drawn into the investigation. The one lichen not mentioned by Van Eeden appeared to be *Cladonia digitata*.

The "Flora van 's Hertogenbosch" which in 1846 was published by F. J. J. Slingsby van Hoven was reprinted in 1879. It differed particularly from the first edition in that it mentioned more *Parmeliae*, *Physciae*, and crustaceous species, the latter especially borrowed from the statements by various collectors. It may be pointed out that *Lobaria pulmonaria* is lacking in the second edition which might be interpreted that this species had disappeared in the meantime. At p. 7 the author stated that his material was preserved in the herbarium of the Botanical Society. What has happened to his collection? I hardly ever saw any of Van Hoven's specimens.

Elsewhere I have made a remark on the apparent lack of interest in collecting lichens during botanical excursions. This perfectly holds good for the excursion in the Island of Terschelling, an account of which appeared in "Ned. Kruidk. Arch." of 1888. No more than 2 lichens, *Peltigera canina* and *Cornicularia aculeata*, had been observed!

The "Flora van Nijmegen" written by Th. H. A. J. Abeleven, and published in "Ned. Kruidk. Arch." of 1889, was an enumeration of the local flora with records on locality and habitat. All of the material collected is present in the collection of the Botanical Society. Important finds were *Anaptychia ciliaris* and *Synechoblastus* (= *Collema*) *vespertilio*.

The "Flora Campensis" (1890) by W. G. Top Jzn was the last flora to appear in this century. It may be observed that after this, no more floras have appeared of any importance to lichenological floristics. The area investigated was limited to the west by the Zuiderzee, and included the municipalities of Kampen, IJselmuiden, Grafhorst, Wilsum, Kamperveen, Zalk, and Veecaten. Top followed the system of Sydow, "Die Flechten Deutschlands" (1887). In the aggregate, 60 lichens were enumerated (p. 56—62), the more important among them being *Ramalina pollinaria* (= *duriaei*), *Parmelia tiliacea* (= *quercina*), *Physcia* (= *Anaptychia*) *ciliaris*, *Physcia stellaris*, *Ph. astroidea*, and some *Collemaceae*.

Since the appearance of the first edition of the "Prodromus Florae Batavae" (1853), much had changed. More and more people had started to pay their attention to the indigenous flora, not only to the Phanerogams, but also to the Cryptogams. More and more also they used to lay down their finds in books or papers, and from all parts of the Netherlands there appeared floras, check-lists of the local wealth of plant life. Not only was there a sharp rise of the number of localities, but also many more species had become known. A reprint of the Prodromus proved a necessity, and this particularly held good for the part dealing with the Cryptogams. Firstly, the revision of the existing collection of *Bryophyta* by Buse and Van der Sande Lacoste involved drastic alterations, but secondly, the collection had enormously increased by the tireless activity of both bryologists. As regards the lichens, even this part of the collection of the Botanical Society, had already been so much enriched by purchase or grant of the herbaria of several members (Acker Strating, Altena, Bondam, Van den Bosch, Buse, De Haan, Van Hall, Sprée, Top, Vrijdag Zijnen, Wttewaal, etc.), as to justify the Prodromus to be reprinted. Th. H. A. J. Abeleven was asked to see this edition prepared, and in 1893 the part containing the *Bryophyta* was completed, in 1898 that containing the *Lichenes*. Approximately 25 % of the lichens proved to be new to the flora! About this edition much the same may be said as about the first. It is of undeniable value to state at a certain moment how many species are known, which species they are, and where they have been found. As, moreover, the Prodromus was based on herbarium material, any subsequent botanist was enabled to compare his finds with the specimens mentioned. Yet, the trouble remained that the Prodromus was nothing but a checklist which could not be used for the identification of the species.

At the conclusion of the 19th century, the attention may be drawn to the voluminous illustrated work entitled "Flora Batava" which I found it difficult to deal with at a certain date, as the work extends over many years. The first volume was started in 1800, entirely written by J. Kops, whereas the plates were attended to by the famous painters J. C. Sepp and his son. Kops (1765—1849) who at first during a few years was a baptist minister at Leiden, and subsequently became — mirabile dictu — a professor of rural economy at Utrecht, intended his "Flora Batava" to be a useful tool in the hands of the contemporary botanists. He wrote it along the lines of the 15th edition of Linnaeus' "Systema Vegetabilium" (1797), adding some remarks on variability, habitat and locality, officinal and domestic use, whereas every species was illustrated by a Royal Quarto coloured plate. In later years, the "Flora Batava" was to be edited by several other botanists, whereas the Sepp's were also replaced. The complete set, i. e. all that has thusfar appeared, consists of 27 volumes, the last one being published in 1930. Lichens appeared no sooner than in the eighth volume (1844) which was edited by J. Kops and H. C. van Hall. However recognisable the plates of the Phanerogams were, those of the lichens were very poor. The lichens depicted were *Peltigera polydactyla* (no. 624), *P. canina* (no. 625), and *Baeomyces roseus* (no. 630).

The 9th volume (1846), under the editorship of Kops and J. E. van der Trappen, shows no. 655, *Lichen parietinus* (= *Xanthoria parietina*); no. 690, *Cetraria* (= *Cornicularia*) *aculeata* and *Parmelia acetabulum*; no. 710, *Parmelia* (= *Anaptychia*) *ciliaris*, all of them being poorly pictured, which is really astonishing and disappointing for a painter of the format of Sepp's.

The 10th volume (1849), edited by Kops and Van der Trappen, contained for no. 794 *Parmelia caperata, saxatilis,* and *perlata,* none of them being really recognisable.

Volume 11, 1853, edited by P. M. E. Gevers Deynoot, contained no. 840, *Usnea barbata* and *Cladonia rangiferina*; no. 858, *Parmelia physodes*; no. 859, *Cladonia coccinea* (presumably *coccifera* was meant); no. 860, *Stereocaulon condyloideum, St. paschale,* and *Lecidea petraea.*

Volume 12, 1865, edited by Gevers Deynoot and Jhr F. A. Hartsen, was the last volume in this century to contain some lichens. They were no. 928, *Cetraria* (= *Cornicularia*) *aculeata* and *Cetraria islandica*; no. 930, *Pertusaria communis* and its var. *amara*; no. 934, *Pertusaria wulfenii* and *Calicium hyperellum.*

The last volume of the "Flora Batava" numbered 27 (1930) was edited by L. Vuyck. It contained descriptions and pictures of *Cladonia bacillaris, Cl. deformis, Cl. floerkeana, Cl. macilenta, Cl. papillaria, Cl. verticillata* (no. 2142); *Cl. uncialis* (no. 2146); *Cl. foliacea* (no. 2150); *Cl. rangiformis* (no. 2154).

Looking back on the work done in the 19th century, we arrive at the following conclusions. The interest in lichens appeared to be considerable; its increase during the 19th century was much greater than that during the 18th century. This increase was largely due to the Botanical Society (founded in 1845), and by the inspiring activity of its chairman R. B. van den Bosch. From various parts of the Netherlands there appeared local floras which also dealt with the lichens. Most authors were no professional botanists. It may be noticed that these floras concentrated on the central part of the Netherlands, Zeeland, the south-west part of the province of Zuid-Holland, and on the coastal region. This does not imply, however, that nothing was collected outside this area, but it may be taken for granted that the islands of the province of Zuid-Holland, as well as the province of Friesland, and most of the province of Limburg were, lichenologically speaking "terrae incognitae". Most of the works mentioned were mere check-lists, the only real flora being the "Flora Belgii Septentrionalis" by H. C. van Hall which covered the entire country. Along with the growing activity of the florists, there was an increase of the number of floristic papers in the newly started journal "Nederlandsch Kruidkundig Archief", coupled with a notable decrease of the number of books on the same subject. In spite of the much greater activity, however, the lichenology in Holland knew no other aim but enumerating species in a row. Nobody thought of using critically the foreign floras, and checking the indigenous species with them. Nobody hit upon the idea of revising some group of lichens, still less of describing any new species himself. The foreign authors were servilely followed. For the sake of honesty, however, it should be added that the botanists, though being interested in lichens, were no lichenologists proper. The stimulus, the contact with the lichenologists abroad, was lacking; and soon the interest would also prove to flag. Nevertheless, the above-mentioned years were the flourishing-period of the lichenology in the Netherlands!

d. *Twentieth century.*

" 'Gooiland'. Een geognostische biologische studie" is the title of a work by C. J. Koning which was published in "De Natuur", vol. 20, 1900, and contained some lichens. The author warned that those Thallophyta, requiring microscopical investigation or being difficult to find, were not entered in his list. The only lichen species enumerated were *Baeomyces roseus, Cladonia coccifera, Cl. rangiferina, Imbricaria* spec., *Peltigera canina,* and *Ramalina* spec.

In the same year, a popular paper, "Uit het plantenleven", by

J. Jaspers Jr containing some data on lichens appeared in "De Levende Natuur", vol. 4, 1900, p. 73—92. No localities were mentioned.

The same number contained an interesting observation made by M. A. Koekkoek who in his paper "Dwars over de Veluwe" described a tour in the hilly northern part of the province of Gelderland in the neighbourhood of the "Uddelermeer". He particularly mentioned the exuberant lichen vegetation: "Vooral waren het de 2 à 3 voet lange draadvormige, grijsgroene *Bryopogon*'s die, als slappe baarden aan de onderzijde der takken bevestigd, een werkelijk grillige vertooning maakten" (Especially the filiform, grey-green *Bryopogon*'s, 2 or 3 feet in length, and fastened to the lower side of the branches, procured a really fantastic spectacle). Obviously, Koekkoek saw a beautiful vegetation of *Usneae*, which we are not likely to see ever again. Instead of the earlier woods, we have got meagre monocultures of pines and well-groomed beech woods, poor and tiresome.

Still in the year 1900 A. C. Oudemans, a nephew of professor C. A. J. A. Oudemans', published a book entitled "Onze flora" which was a revision of Hoffmann's "Bilder-Atlas". Some representatives of the lichens (which were still classified as algae!) were dealt with on p. 189—191, with record of their use in former times.

The section Rotterdam of the "Nederlandsche Natuurhistorische Vereeniging" (Netherlands Society for Natural History, a union of mostly amateur naturalists) in August 1918 made an excursion to the Island of Ameland, an account of which appeared in the journal of this society, "Natura". At p. 109 the name *Xanthoria parietina* was mentioned which was found on whale bones.

Th. Weevers, in a paper "De plantengroei van het eiland Goeree in verband met zijn bodem en geschiedenis" (The plant growth of the Island Goeree in connection with its soil and history) (in Ned. Kruidk. Arch., 1921) mentioned on p. 112 a single lichen, viz. *Cladonia rangiferina.*

W. Beijerinck in publishing his paper "Het Lheebroeker Zand" in "De Levende Natuur" (1924) mentioned the occurrence of richly fruiting *Cornicularia aculeata.* As apothecia in this species are rare, it may be of interest to note that I also found fertile specimens after brief searching in the same nature reservation.

Under the title of "De mossen van Meyendel", Miss C. Cool in "Natura" (1924) reported on the mosses, hepatics, and lichens found during an excursion in the dunes near Wassenaar. As she was more familiar with fungi, this may account for the erroneous use of some lichen names such as *Ramalina calicaris, Cladonia fimbriata, Cl. rangiferina. Parmelia saxatilis* (erroneously written *saxatile*) does occur in Meyendel (a certain area in the dunes near Wassenaar), but it is much rarer than its relative *P. sulcata.* What was meant by *Parmelia olivascens* remains obscure, the addition "fruct.", however, suggests *Parmelia acetabulum* which is abundant on old poplars in the dunal region.

When the plans of closing the Zuiderzee took a definite shape, in 1927 a committee, appointed by the Netherlands Botanical Society, was charged to deliver a floristic inventory of the surrounding regions. It was hoped that this committee could start its work in time so as to get an insight into the changes due to the desalination of he water. On its instigation, several members of the Society undertook an investigation of the flora, and their reports were issued in the periodical "Correspondentieblaadje Zuiderzeeonderzoek". Thus, Mr and Mrs Koopmans—Forstmann investigated the flora of the Frisian coast, but, not being trained on lichens, they only noticed the commonest. In their paper "Onderzoek van de Friese Zuiderzeekust in 1927" (Investigation of the Frisian Zuiderzee-coast) (Correspondentieblaadje, no. 10, 1928), the one lichen mentioned was *Xanthoria parietina* found on weather-beaten posts of the sea dike near Hindeloopen.

Once in a while, reports on excursions for the use of the investigation of the Zuiderzee were also published in "Ned. Kruidk. Arch.". The 14th communication of the Zuiderzee Committee contained "De Flora van Wieringen" (in Ned. Kruidk. Arch., [1931] 1932), starting at p. 245 with a general review on the floristic investigation of the Island of Wieringen. Therein it was stated that the first communication to appear on the flora was contributed by C. M. van der Sande Lacoste who visited the island in June 1856 (see p. 22). Several statements on Phanerogams followed up to the year 1859, after which 70 years of a complete standstill elapsed, though it is known that botanists did visit the island. Thanks to the activity of the Zuiderzee Committee the inventory of the flora was strongly promoted after 1927. However, the lichens were usually neglected, which is the more deplorable since the dikes were said to have been crowded with them. F. Florschütz, who in the communication quoted dealt with the lichens, mentioned the occurrence of *Peltigera malacea* and *Ramalina calicaris.* Unfortunately, no material was preserved.

Florschütz also identified the lichens Mr and Mrs Koopmans—Forstmann had collected on the Frisian coast near Zurig, mentioning them in their paper "Enkele lichenes van de Friesche kust" (Some lichens from the Frisian coast) (Correspondentieblaadje 2, no. 14, 1932). Locality and habitat were accurately stated, but the harvest was very poor, consisting of *Xanthoria parietina* and *Physcia leptalea* only. As the latter is very rare in Holland, I examined the material, and found *Physcia tenella* instead, together with *Buellia canescens.*

Two more lichens were reported from the Frisian coast by M. Wiegersma and Mr and Mrs Koopmans in their paper "De flora van een buitendijksch terrein bij Laaxum in Z. W. Friesland" (The flora of an area outside the dikes near Laaxum in S. W. Friesland) (Correspondentieblaadje 3, no. 2, 1933). They are *Cladonia* spec. and *Peltigera* spec. Later on (in Correspondentieblaadje 4, no. 1, 1933) the latter was recognised to be *Peltigera canina* by W. J. Lütjeharms.

An excursion of undergraduates of the Leiden University to the Island of Voorne in June 1934 resulted in an account of the plants found, compiled by Miss C. J. E. Wiegand Bruss in her paper "Eenige floristische gegevens omtrent het eiland Voorne" (Some floristic data on the Island of Voorne) (Ned. Kruidk. Arch., vol. 45, 1935). On a total of 424 species only 3 lichens had been observed which does not really correspond to the actual ratio! These lichens were *Cladonia foliacea, Cladonia* spec., and *Xanthoria* spec.

In 1935 there appeared a booklet entitled "Mossen en Varens" (Mosses and Ferns) by S. Broekhuizen in which in chapter IV the lichens were incidentally and in a popular way dealt with.

Some lichens were mentioned by W. Beijerinck in his paper "De Dwingeloosche Heide" which was published in "Jaarboek der Vereeniging tot Behoud van Natuurmonumenten in Nederland 1929—1935", 1936. In this paper the flora was considered in connection with the geological and ecological properties of the heath concerned which is a nature reservation. In marshy heaths were observed *Cornicularia aculeata, Cladonia macilenta,* and *Cl. foliacea* (p. 180), whereas the inland dunes showed a vegetation of typical sand plants mixed with *Cladonia rangiferina, Cl. uncialis, Cl. gracilis, Cl. furcata, Baeomyces roseus, Lecidea granulata,* etc. (p. 181).

A paper "Heide en veen in N.W. Drente" (Heath and moor in N.W. Drente) was published by Fop I. Brouwer in "De Levende Natuur", vol. 40, 1936. The author described the origin, the succession, as well as the zonation of knobbs of *Sphagnum.* These very interesting formations are due to the peculiar growth of *Sphagna* and species of *Polytrichum.* The apices of the knobbs gradually grow higher and drier, and eventually get grown over by *Sphagnum rubellum, Sph. fuscum, Erica tetralix, Calluna vulgaris, Vaccinium oxycoccus, Empetrum nigrum,* and such lichens as *Cladonia rangiferina, Cl. coccifera, Cetraria islandica,* and *Ochrolechia tartarea.* The author kindly informed me that no lichens were collected, which is a pity indeed, as it may have been of importance to know what was meant by the last-named species.

A report on the excursion of the Netherlands Botanical Society to the Island of Ameland, August 26—31, 1936, was compiled by Koopmans—Forstmann (in Ned. Kruidk. Arch., vol. 46, 1936). In this report, the lichens were identified by E. T. Nannenga, then assistant at the Utrecht University Herbarium. For the very first time we meet with an account where *Cladonia rangiferina* and *Cl. coccifera* have been done away with! The former was replaced by *Cl. mitis* and *Cl. tenuis,* the latter by *Cl. floerkeana.* The results of the excursion were compared with the thesis by Holkema (1870) who enumerated 11 lichens, 6 of which were found again. The fact, however, that such a common species as *Cornicularia aculeata* was not found again, is in my eyes a proof that lichens were not purposely collected. Yet, during this excursion, some lichens were collected unknown to Holkema. Particularly, the find of *Peltigera malacea,* a species sparingly collected in the central part of Holland about the middle of the nineteenth century, and long since considered extinct, was most surprising.

Up to 1936 the lichens had not yet been drawn into a sociological investigation. More and more, however, it was realised in Holland that lichens, and Cryptogams in general, could not be dispensed with in sociology; of course, this holds for the terricolous lichens, as the arboricolous ones are generally considered separately. E. Meyer Drees in his thesis "De bosvegetatie van de Achterhoek en enkele aangrenzende gebieden" (The wood vegetation of the "Achterhoek" and some adjoining areas) (1936) investigated those woods in the east part of the province of Gelderland which are considered least affected by human activities. The author identified the lichens with the aid of Lindau, "Kryptogamen-Flora für Anfänger" (1912). It appeared that the only woods showing some trace of lichen growth in the moss stratum were 1, the *Querceto-Betuletum typicum*; 2, the *Querceto-Betuletum molinietosum*; and 3, the pine woods on a *Querceto-Carpinetum stachyetosum*-profile or on a *Querceto-Betuletum molinietosum*-profile. The lichens in these associations being of minor importance were qualified as "companion species" and "accidental species". The majority belonged to the genus *Cladonia*, in a single case a *Peltigera* was found.

In continuation to the work of the Zuiderzee Committee, J. L. van Soest made an inventory of the flora around Blokzijl, a report on which was published in "Correspondentieblaadje Zuiderzeeonderzoek" of 1936, and in "Ned. Kruidk. Arch." of 1937. The lichens were identified by F. Florschütz to be *Physcia tenella, Xanthoria parietina,* and *Caloplaca* spec.

A few remarks by H. de Miranda on *Cladonia* appeared in "Amoeba" of 1937. This is a journal edited by and intended for the Nederlandse Jeugdbond voor Natuurstudie (Young Naturalists' League). This fact might account for the drastic pruning on the species the rich subgenus *Cenomyce* has suffered here which resulted in 2 species left, viz. *Cl. coccifera* and *Cl. pyxidata,* respectively representing the *Cladoniae* with red and with brown apothecia.

A. J. M. Garjeanne, better known as a bryologist, wrote a paper entitled "Korstmossen" (in "De Levende Natuur", vol. 42, 1937/1938), being a popular treatise on the nature, the structure, and the way of living of the lichens in general, and of some genera in particular.

In his next paper "*Cladonia*'s met rode sporenvruchten" (*Cladoniae* with red apothecia) in "De Levende Natuur", vol. 43, 1939), Garjeanne dealt with the *Cocciferae* of the genus *Cladonia,* expatiating on their morphology and the uncertainties of identifying them.

A valuable paper on systematics entitled "The importance of the gonidia to the classification of the lichens" was published by E. T. Nannenga in "Recueil des travaux botaniques néerlandais" (1939). The author advocated "the desirability of basing the classification of the lichens on their fungous components".

In 1940 W. Beijerinck published his admirable "*Calluna,* a monograph on the Scotch Heather" in which also mention was made of a number of lichens (p. 115—116) which appear as companion plants of the "true *Calluna* heaths" in the Netherlands and N.W. Germany. As Beijerinck in his list did not care about stipulating localities in either country, the extent of the Dutch share is unknown, and the data are of little value to the knowledge of the distribution. Presumably, however, the heaths of Drente — or rather what was been left of them — will be little behind those in N.W. Germany, the wealth of which was described by H. Sandstede.

The 19th volume of "Amoeba" (1940) contained a paper on lichens by J. W. Dijk. The title, "Korstmossen", it quite unpretentious, and so are the contents.

For the sociologists among the members of the Young Naturalists'

League (in Dutch abbreviated into N. J. N.), a stencilled paper was distributed entitled "Onze droge graslanden" (Our drier grasslands) (1940). The work was brought about by the collaboration of J. Heimans, J. Meltzer, F. Stafleu, and V. Westhoff. It dealt with the sociology and ecology of what is represented of the *Corynephorion canescentis* and *Bromion erecti* in Holland. Ecologically speaking, the difference between both grasslands is that the *Corynephorion* comprises the associations of the dry, oligotrophic sands poor in lime, whereas the *Bromion* associations — as far as Holland is concerned — occur in favourably exposed, eutrophic, and sometimes limy places. Still, boundaries are not sharp, witness the transitional stages in dunes which gradually leach out. Without entering into further detail, it appears from that paper that lichens (several *Cladoniae, Peltigera canina* and *polydactyla, Cornicularia aculeata*) play an important part in the associations of both *Corynephorion* and *Bromion*. These are the *Corynephoretum canescentis* of the inland dunes (consisting of the subassociations *typicum, agrostidetum caninae,* and *cladonietosum*), and the associations of the dunes: *Corynephoretum canescentis dunense* and *Festuceto-Galietum maritimi*. Associations belonging to the *Bromion erecti* and showing some lichen growth are the *Tortuleto-Phleetum arenarii* (which in the same year was transferred to the *Koelerion albescentis* [Th. Weevers in Ned. Kruidk. Arch., vol. 50, 1940, p. 313]) and the *Anthyllideto-Silenetum otitis*. At that time few lichens characteristic for these associations were known by the authors, whereas one of them, V. Westhoff, moreover informed me that he did not vouch for the accuracy of the determinations. It is to be expected that along with a better knowledge of the lichens, there will be an increasing understanding of the part played by these Cryptogams in certain pioneer associations.

In "Ned. Kruidk. Arch.", vol. 50, 1940, a report was published on the plants observed during the excursion of the Netherlands Botanical Society from August 21—26, 1939, in the surroundings of Winterswijk. It also contained a check-list of 16 lichens compiled by E. T. Nannenga, none of which need special mentioning.

Another excursion, from August 18—25, 1941, was directed to Oirschot and surroundings. Of the lichens collected by W. H. Wachter an account was given by the present author in "Ned. Kruidk. Arch." vol. 52, 1942. None of the 10 lichens were notable.

Whereas in the beginning, it was somewhat hesitatingly admitted that lichens ought to be considered in sociological investigations, J. Meltzer and V. Westhoff in their "Inleiding tot de Plantensociologie" (Introduction into plant sociology) (1942) clearly represent the viewpoint that the knowledge of Cryptogams forms an important part of the investigation. At several places in their book lichens were mentioned, though localities were not recorded, as could not be expected indeed in a textbook of this kind. Only photograph no. 5 pictures a detail of the dunal vegetation in the Island of Terschelling, showing *Parmelia physodes, Peltigera canina,* and *Cladonia furcata*.

The same photograph was used for illustrating a paper in "In Weer en Wind", vol. 6, 1942, by J. Meltzer, entitled "Strand en duinen VII" (Beach and dunes). In this popular monthly for amateur naturalists

Meltzer expounded the succession of plant communities going from the shore to the land inward. The first association to show some lichen growth is the dunal form of the *Corynephoretum canescentis*, the subassociation *dunense*, which is characterised by the lichen *Cornicularia aculeata* (p. 36). Other lichens recorded to occur in this community, sometimes dominating the vegetation, are *Usnea barbata* (= presumably *Usnea sorediifera*), *Parmelia physodes, Peltigera canina*, and some *Cladoniae* (p. 37).

Lichens were also mentioned incidentally in an admirable paper by Mr and Mrs Westhoff—De Joncheere (Tijdschrift over Plantenziekten, 1942). The paper, entitled "Verspreiding en nestoecologie van de mieren in de Nederlandsche bosschen" (Distribution and nesting ecology of the ants in the Dutch woods), contains, amongst others, short ecological descriptions of 22 types of woods (11 associations and subassociations of more or less natural woods, 10 cultivated woods, 1 sand-drift with scattered pines), together with the record of the combinations of ant species inhabiting them; the ecology of the ant nests; the ecology of the ants themselves; and, finally, the sociological tables of the wood types. Lichens, identified by E. T. Nannenga, were observed to occur in woods of *Pinus silvestris* (viz. *Cladonia alcicornis*, and several other species, *Cornicularia aculeata*, p. 197), and in a wood of *Quercus rubra* (*Cladonia* spec., p. 201).

In the same year (1942), a booklet "Overzicht der Plantengemeenschappen in Nederland" (Survey of the plant communities in the Netherlands) was published by V. Westhoff, J. W. Dijk, and H. Passchier, being an enumeration of the indigenous associations. The *Corynephoretum canescentis* is characterised by a few Phanerogams and by *Cornicularia aculeata* (p. 38), its subassociation *C. c. cladonietosum* by *Cladonia fimbriata, coccifera* (sensu latiore), *sylvatica* (s. l.), *furcata* (s. l.), *gracilis*, and *uncialis* (p. 39). Species characteristic for the *Ericetum tetralicis cladonietosum* (p. 56) are *Cladonia uncialis, squamosa, gracilis, chlorophaea, sylvatica*, and *Cornicularia aculeata*. This work was revised by V. Westhoff and G. Sissingh, and reprinted in 1946. With slight alterations, the lichens dealt with above are mentioned at pages 63, 64, 65, and 88.

In 1943 A. Quispel took his Ph. D. degree on a thesis "The mutual relations between Algae and Fungi in Lichens" which was published in "Rec. Trav. Bot. Néerland.", vol. 40. The author started with the statement that to augment the knowledge about the mutual relations it is necessary "to cultivate both partners in pure culture and to investigate their physiological properties". This investigation led him to various striking results (p. 532) some of which are quoted here: "13. On the other hand it appeared that the alga *Apatococcus minor* synthesizes a remarkable metabolic product provisionally named apatococcin. 14, ... A relationship with certain aliphatic lichenic acids is probable. 15, The literature concerning the problem of the production of lichenic acids is reviewed and it was concluded that as certain fungi can produce certain lichenic acids, and certain algae can produce similar substances in pure culture the lichenic acids cannot be regarded as the result of a specific metabolism of the symbiosis. We have only the right to speak about an accumulation of these substances as a result of the symbiosis in some cases. 18, The protective influence of the fungus against desiccation of the algae only is very small and can only be perceived when the desiccation is not too intense. 19, The lichen-symbiosis is compared with other cases of symbiosis and it is concluded that the differences are only apparent, while there is a great similarity as in all other symbiosis the exchange of nutrilites [1]) plays one of the most important roles".

To the 29th meeting of the "Nederlandsch Natuur- en Geneeskundig Congres" at Amsterdam, V. Westhoff read a paper "Plantensociologisch onderzoek, in het bijzonder op de Waddeneilanden" (Plant sociological investigations, particularly in the Frisian Islands) which was subsequently published in "Handelingen" (1943). After a preliminary survey of the origin and growth of plant sociology, and of the different schools (French-Swiss and Scandinavian), Westhoff proceeded to describe the associations of the Frisian Islands. The lichens mentioned were *Cladoniae* (species not identified) and *Cornicularia aculeata* which grow in the *Violeto-Corinephoretum dunensis*, the lichen-steppe which covers the largest part of the older dunes in the Island of Terschelling. On moist north facing slopes terricolous specimens of *Parmelia physodes* may be found.

In 1944 W. D. Margadant published a booklet entitled "Mossentabel" which was meant to be a key to the mosses, hepatics, and lichens of the Netherlands. As regards the latter, Margadant only considered the most conspicuous species of the foliose and fruticose lichens, whereas large groups of crustaceous lichens were only vaguely hinted at. In some cases, the key only carries as far as the genera, e. g. the genus *Physcia*. The author made an attempt at basing his key on characters distinguishable in the field, but he may have observed that lichens just do not lend themselves to this procedure.

In their paper "Landschap en plantengroei van Oost-Twente" (Landscape and plant growth of Oost-Twente) (in "Natuur en Landschap", 1946, p. 9) Westhoff and Van Dijk mention the regular occurrence of *Cetraria islandica* in the easternmost portion of the province of Overijsel.

A short but thorough and critical paper was written by J. J. Barkman (in Vakblad voor Biologen, 1946), entitled "Over oecologie en sociologie der cryptogame epiphyten" (On the ecology and sociology of the cryptogamic epiphytes), in which also a number of lichens were mentioned.

When considering what has been done in the twentieth century in the field of lichenology, we may state that the number of publications somehow dealing with lichens even slightly surpasses that of the previous period, in spite of the fact that not yet half of the present century has elapsed. Largely being papers, these publications appeared no more exclusively in "Ned. Kruidk. Arch.", but also in other journals of a more popular nature. The quality of the papers, however, has markedly dropped compared with those of the preceding century. It may be true that the earlier floras were, properly speaking, little more than dull check-lists without any descriptions and devoid of any critical remark, yet they were a proof that the authors, being interested in plants, did a good deal of work in preparing their papers and endeavoured to get thoroughly acquainted with the flora. Suffice it to mention that years and years of collecting and of identification work were needed to prepare every individual check-list. All this seems, as far as the lichens are concerned, to have gone lost. If in any paper lichens were mentioned at all, there were only few of them, and usually they were ordinary species. Florists knowing both Phanerogams and Cryptogams, more particularly lichens, were very rare; only the mosses never failed to attract some amateurs. In my opinion, the decline of lichenology in the Netherlands became manifest about 1900, since after the "Flora Campensis" by Top (1890), and the second edition of the "Prodromus Florae Batavae" (1898) very little of importance had appeared. Had the gap between the lichenology abroad and the knowledge of lichens in the Netherlands grown so wide that the florists had lost their way? Rising high above the mass of unsignificant papers stands the short systematical paper by E. T. Nannenga and the physiological thesis by A. Quispel which convey the impression that the lowest depression is at an end. It is an important and encouraging sign, too, that recently some sociologists realise the value of a better knowledge of the lichens. A steadily growing number of sociological publications mentioning lichens demonstrate their changing view. Finally, mention should be made of a trend characteristic for the present time to popularise the knowledge of lichens with disregard of the use of the microscope, a phenomenon we do not deem very much promising.

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[1]) "For the sake of uniformity I will always use the term nutrilities instead of the more usual words vitamines, hormones, growth factors, accessory substances etc." (p. 427).

3. Summary.

It was shown that the oldest Dutch lichen herbarium known was that of H. Boerhaave dating as far back as the end of the 17th or the beginning of the 18th century. After that there was a long spell of inactivity, until from about 1835 onward the florists again started making herbaria. From the end of the nineteenth century the interest flagged again, and collecting was done by very few people.

The first publications which are known to deal with Dutch lichens mentioning the locality do not date back farther than the 17th century, the work by C. Pilleterius (1610) being the oldest one. Those earliest publications comprised but a very small number of lichens, presumably because of few of them the officinal application (the main impetus of getting acquainted with plants) was known yet. In the seventeenth century, the lichens were designated by phrase-names which, with some certainty, may be identified with the Linnean names, but nevertheless remain somewhat obscure. Gradually, in the 18th century, the interest in lichens shifted from the medicinal to the botanical side. The number of lichens known steadily increased, and the binomial nomenclature was more generally applied. The habit of uncritically copying certain successful foreign floras was abandoned, and it grew customary among the florists to publish check-lists of own finds, though specific descriptions were often borrowed from foreign authors. In some cases, however, it still appears uncertain which species were meant, as no material was left. The lichenology in Holland showed its greatest development in the 19th century. This was undoubtedly mainly due to the activity of the newly founded Botanical Society (1845), and particularly by the efforts of its undefatigable president R. B .van den Bosch. Except for the experimental investigation by M. Treub (1873), however, the interest in lichens never surpassed the stage of writing enumerations of the local flora. None of the florists felt called upon to study any special group of lichens. In fact, there were no lichenologists proper, and lichenology in Holland was sterile. Whereas in all other countries of Europe the description of new lichen genera and species was in full progress, and other branches connected with lichenology such as anatomy, morphology, ecology, physiology, and chemistry were being studied, there was an almost complete standstill in the Netherlands which hardly could be made up for by a single outstanding systematical (E. T. Nannenga, 1939) or physiological paper (A. Quispel, 1943). Of late, however, a revived interest and a determined desire on the part of some sociologists getting more familiar with lichens is apt to brighten up this somewhat gloomy picture.

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CHAPTER II.

GLOSSARY OF TECHNICAL TERMS.

In several lichen-floras the authors have prefaced the systematic part with an introduction dealing with morphology and anatomy, and this practice is a necessary one for such a specialised subject as is lichenology. It is, nevertheless, a striking and regrettable fact that some authors do not attempt to further the consistent use of certain technical terms, apparently because there is little agreement as to their definition. Yet, there are several papers in which newly introduced terms have been clearly explained. By compiling these and other papers cited at the end of this chapter, I have tried to arrive at a useful terminology, though further particulars concerning the chemistry of lichens or the structure of such species which do not occur in this country must be left out of consideration. I may refer those readers who desire to enter into these details to the papers mentioned above.

Adhesive disc. — A small plate-shaped broadening of the base of the primary stalk by means of which many *Usneaceae* are attached to the substratum.

Rhizinae, too, may be broadened at their distal end into an adhesive disc, as in *Parmelia subaurifera* (see under thallus).

Amphithecium. — See under apothecium.

Apothecium. — With the exception of the tropical subclass *Hymenolichenes*, all lichens have reproductive organs comparable to those of the *Ascomycetes*. They are therefore called *Ascolichenes*. In this group we may distinguish two series, according to their so-called fruits (reproductive organs), first the *Pyrenocarpeae*, having a perithecium (see there) which is the analogon of the reproductive organ in *Pyrenomycetes* among fungi; and secondly the *Gymnocarpeae*, having an apothecium. More properly the suborder of *Cyclocarpineae*, to which belong the bulk of the lichens, show in their apothecium great likeness to the *Discomycetes*. The terminology of the apothecial outer and inner structures used here mainly originates from Darbishire (1898) and Frey (1936). By the way, it may be emphasised that the most peculiar structures found in the apothecia of various tropical lichens have not been dealt with here. The apothecium may be sessile or pedicellate, whilst very long-stalked apothecia are found in *Caliciaceae* and some *Cladoniaceae*; on the other hand the apothecia may be more or less hidden either singly or in small groups sunk in thalline warts as met with in *Pertusariaceae*. Outlining the form of the apothecia, we may say that there are two main types: the linear or oblong-ellipsoidal ones

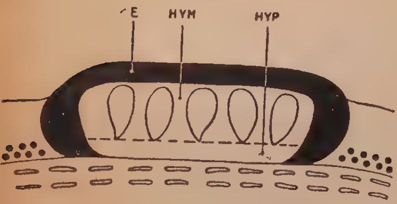


FIG. 1

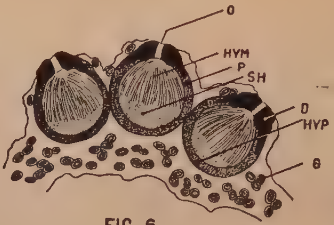
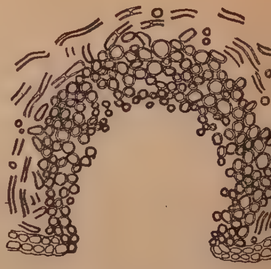


FIG. 6



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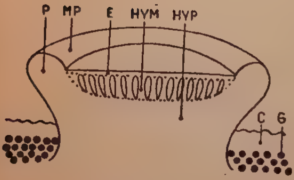
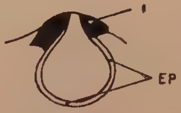


FIG. 2



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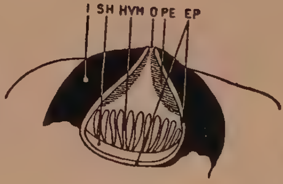

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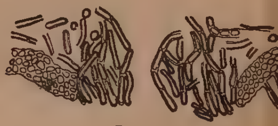

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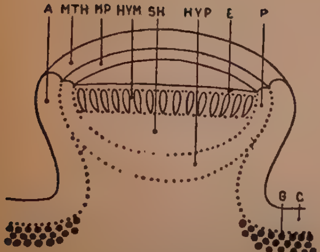

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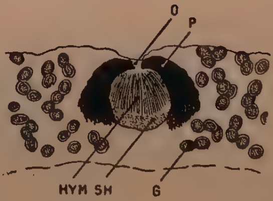

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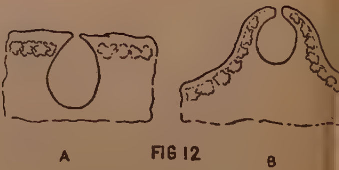

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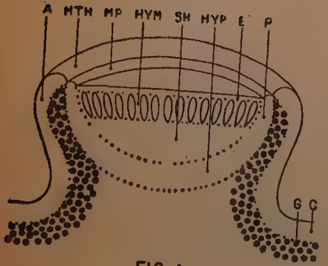

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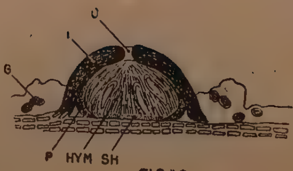

FIG. 10

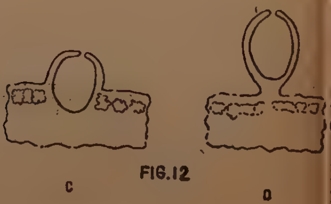

FIG. 12

(lirellae) which only occur in *Graphidineae,* and the orbicular ones which occur in all three groups, *Coniocarpineae, Graphidineae* and *Cyclocarpineae.* In contrast to the linear apothecia, the roundish ones in *Graphidineae* are sometimes also called ardellae.

Externally, we only see a disc which may or may not be enclosed in a tissue, usually differing from it in colour and texture; a vertical section, on the other hand, will reveal more. The most important tissue is the hymenium, called thecium by Darbishire; it is built up of asci and paraphyses. Within the asci the spores are formed, generally to the number of eight but there may be less, down to 2 or even 1 per ascus (*Pertusaria monogona*), or more up to some 200 so-called myriosporous asci as may be found in some *Biatorella* species. As to their form, size and inner structure, there exists an extraordinary variability which, of course, cannot be described here, except for a few terms connected with the septation. The more simple types are the one-celled and two-celled spores. When the lumen of the spores is divided by 2, 3 or more septa so that a row of consecutive cells is being formed, the spores are called parallel 3-, 4- or many-celled, according to the number of cells. In *Peltigera* e. g., the spores are parallel 4—8-celled. When, on the other hand, the septation is extended into two perpendicular directions and the cells consequently resemble very much the masonry of a wall, the spores are called muriform. Examples occur amongst the genera *Endocarpon, Leptogium, Rhizocarpon.*

The lumen of some 2-celled spores may be reduced by extreme thickening of the inner cell-wall (endosporium), as we see in *Anaptychia* and *Physcia*; a separate name is not applied to such spores. A similar condition is shown in the spores of *Teloschistes* and *Xanthoria,* but in this case they are called polarilocular because of the two lumina being placed at the very ends of the spore. These lumina are connected by a narrow canal which, often obscurely, pierces the septum.

Finally, it may be mentioned that beside colourless spores there occur many others with a coloured outer cellwall (episporium).

The asci are surrounded by paraphyses, i. e. simple or furcate,

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Fig. 1 — Arthonioid type of apothecium, transection; fig. 2 — Protolecideoid type of apothecium, transection (after E. Frey); fig. 3 — Superlecideoid type of apothecium, transection (after E. Frey); fig. 4 — Lecanoroid type of apothecium, transection (after E. Frey); fig. 5 — *Sticta sylvatica* (Huds.) Ach. Transection showing lower cortex and cyphella (after Moreau); fig. 6 — *Porina mammillosa* A. Zahlbr. 3 perithecia transected (after von Keissler); fig. 7 — *Verrucaria ruderum* D.C. Perithecium transected (after Zschacke); fig. 8 — *Verrucaria maculata* Zschacke. Perithecium transected (after Bachmann); *Porina byssophila* A. Zahlbr. Perithecium transected (after Von Keissler); fig. 10 — *Arthopyrenia fallax* Arn. Perithecium transected (after Von Keissler); fig. 11 — *Pseudocyphellaria crocata* (L.) Vain. Transection showing lower cortex and pseudocyphella (after Moreau); fig. 12 — 4 ways in which pycnids may occur in or on the thallus (after Glück).

A, amphithecium; C, cortex; D, darkened part of parathecium; E, epithecium; EP, excipulum proprium; G, gonidia; HYM, hymenium; HYP, hypothecium; I, involucrellum; MP, margo proprius; MTH, margo thallinus; O, ostiolum; P, parathecium, PE, periphyses; SH, subhymenium.

sterile and more or less conglutinate threads which are usually coloured at their apices. This coloured, frequently granula-covered zone is called epithecium, but it may be borne in mind that it is no separate tissue. From the outside we see the epithecium as the disc which not invariably shows a smooth surface. It may become wrinkled or cracked with age and in *Umbilicariaceae* it is occasionally grooved.

A very primitive type of apothecium is found in *Arthonia*, simply consisting of a hypothecium (see underneath) and a hymenium only. Remarkably enough, this kind of apothecium, which I propose to call the arthonioid type (fig. 1), has not been considered by Frey.

Now, to explain the further tissues in the more derived types of apothecia, it will be advisable to follow Frey's classification. This author regards the protolecideoid type of fruit as the more primitive one, to be found in *Lecanactidaceae* and a good many *Lecideaceae* (fig. 2). In this type the apothecium is formed without the co-operation of the thalline cortex and consists of the hypothecium only which, continued up the sides of the fruit, gradually merges into the parathecium, thus providing the margin proper or margo proprius of the disc. The combined hypothecium and parathecium is called excipulum proprium, "das Eigengehäuse" of the authors writing in German. Hypothecium as well as parathecium may be built up of colourless, more or less loosely interwoven hyphae or they may be dark brown and carbonaceous (the colour and the quality of the excipulum formerly was the base of a classification in a lecideine and a biatorine apothecium, see e. g. Lindau, 1913, Migula, 1929 and Smith, 1918).

The superlecideoid (fig. 3) and the lecanoroid (fig. 4) apothecia, as understood by Frey, are the more highly developed types which means that they stand farther away from the original *Discomycetes*-type. In both cases the thalline cortex grows along with the hypothecium, thus forming the outer wall or amphithecium at the sides and the thalline margin or margo thallinus at the top of the apothecium. At the base or, in pedicellate apothecia, in the stalk, amphithecium and cortex of the thallus proper gradually merge into each other.

Base and surrounding tissue of the apothecia are sometimes jointly referred to as receptacle but this term is rather to be avoided as it is applicable to all types of apothecia, at one time indicating the hypothecium, at another the amphithecium.

When, in describing the apothecium, we speak of the margin, usually the margo thallinus is meant, as the margin proper is generally less developed and consequently of minor systematic value. Sometimes, even this margin proper is wanting.

The superlecideoid type is to be looked for in species of the genus *Lecidea*, in *Cladoniaceae* and in *Umbilicariaceae*; it is different from the lecanoroid type in that in the latter there are gonidia enclosed in the amphithecium. In both types, however, algal cells may occur in the medullary tissue below the hypothecium.

The subhymenium, finally, is a tissue between hymenium and hypothecium, but it is not always easily recognisable.

Ardellae. — Roundish type of apothecia characteristic of *Graphidineae.*

Areolate, areoles. — In most epigenous crustaceous lichens the thallus is intersected by innumerable small and narrow cracks bordering pentagons or hexagons. These polygons are called areoles whilst the thallus made up of them is called areolate.

As to the biological significance of these areoles I may refer to Nienburg (1926, p. 36) and Miss Fry (1924).

Areoles may also occur in foliose lichens at the upper surface of which soredia or isidia are so closely packed as to form a dense layer that will get more and more cracked in the course of its development.

Ascus. — See under apothecium.

Biatorine. — A word much used in lichenological literature and referring to the apothecium. When the thalline margin is wanting and the excipulum is soft and colourless or nearly so, the apothecium is called biatorine. See also under apothecium.

Breathing pore. — Aperture in the upper cortex through the top of thalline warts by which the medulla communicates with the open air. Breathing pores have as yet been found only in *Parmelia aspera* (Rosendahl, 1907, p. 412). E. Frey (1929, p. 230) proposes the name "pseudolenticel".

Caninoid venation. — See under veins.

Capillitium. — A thready mesh-work. See also under macaedium.

Cephalodium. — External or, more rarely, internal parts of the thallus where the hyphae are connected with alien algal cells of one or even two different kinds. These structures look like warty, squamulose or even fruticose cecidia; they occur more usually on the upper, more rarely on the lower surface of the thallus and, as a rule, differ from it in colour. According to Moreau (1921), the thallus can engulf cephalodia that originate on its lower surface, so that they finally are found in its interior.

Acharius (1803, p. XIX) was the first to use this term, though with a quite different meaning. From the explanation on page 11 of his Lichenographia Universalis, 1810, it becomes clear that Acharius has meant pycnids.

Cephalodia have sometimes been regarded as pathological phenomena, for instance by Moreau (1919, 1921, 1926). Be that as it may, these structures provide reliable diagnostic characters.

In most cases cephalodia contain blue-green algae and occur in lichens which have bright green gonidia, but cephalodia containing bright green algae are not rare, as for instance in species of *Aspicilia* and *Parmelia.*

According to Forssell (1882, 1884), cephalodia have been found in more than 100 lichen species; for details I may refer to that author.

Cilia. — Thread-like appendices to the thallus lobes of *Anaptychia, Cetraria, Cornicularia, Parmelia* and *Physcia* species. As a matter of fact, cilia are usually inserted on the margins and at the tip of the lobes but now and then they may emerge from the lower surface. They are not always strictly distinguishable from rhizinae; in some *Physcia* species, for instance, transitions between them and these rhizinae are recorded.

Conidangium. — An expression used by Sandstede (1931), to replace the more customary word pycnid (see there).

Conidia. — Used by Sandstede and others, standing for pycnoconidia (see there).

Cortex. — See under thallus.

Cyphella. — A break in the lower cortex only known in the genus *Sticta*. The medulla above the cortex is hollowed out so as to form a roundish or oblong excavation, lined with a layer of loosely connected, globular cells (fig. 5).

As far back as 1803 this term was in use by Acharius but he mistook these cyphellae for some kind of apothecia as is evident from page XII of his Methodus Lichenum.

Disc. — See under apothecium.

Endobasidial fulcrum. — See under pycnid.

Endogenous. — The thallus of crustaceous lichens is called endogenous when the greater part of it is immersed in the substratum. In some cases the fruits only are visible. Where these thalli inhabit the cork-layer of trees, they are termed endophloeodic; thalli growing in limestone are called endolithic.

Endolithic. — See under endogenous.

Endophloeodic. — See under endogenous.

Endosporium. — Inner cell-wall of a spore.

Epigenous. —The thallus of a lichen growing on any substratum is called epigenous. It may grow upon wood or bark and it is then called epiphloeodic, or on stone, brick or rooftile in which case it is termed epilithic.

Epilithic. — See under epigenous.

Epiphloeodic. — See under epigenous.

Episporium. — The outer cell-wall of a spore.

Excipulum. — See under apothecium.

Exobasidial fulcrum. — See under pycnid.

Fabiform. — Applied to bean-shaped spores.

Fibrils. — Simple branches perpendicular to the main one in *Usnea*; they are so called in contrast to those branches which in their turn are furcate or again bear fibrils.

In *Cornicularia* the term fibrils is used for the longish lashes into which, occasionally, the short thorns have developed.

Folioles. — Small leaf-like excrescences of the thallus.

Fulcrum. — See under pycnid.

Gonidia. — Algal constituents of the thallus. The name gonidia originates from Wallroth (1825). The algae may be blue-green, belonging to the *Cyanophyceae* or they are bright green *Chlorophyceae*, whereas yellow-green or orange colours are displayed in *Trentepohlia* gonidia. *Cyanophyceae*, e. g. *Nostocaceae* are to be found in *Collema, Leptogium, Pannaria, Peltigera* and in cephalodia of *Stereocaulon*. Bright green *Palmellaceae* are the gonidia of most foliose and fruticose lichens.

Hairs. — Hairs are appendices to the thallus occurring in a few lichens only. Simple hairs have been described in some brown *Parmelia* species (Rosendahl, 1907). Further, they are known to occur in the upper and lower surface of *Peltigeraceae* and the underside of *Stictaceae*. In *Peltigera* e. g., the hairs of the upper side are, as a rule, irregularly branched and entangled, forming the well-known felt. In most *Stictaceae*, the hairs at the lower side have developed into a rough, felty coating with which the thallus is attached to the substratum.

Haptera. — Every organ connecting two parts of the same thallus or one thallus to another or to an alien body, is called haptere. Haptera are known in *Cetraria*, but especially in *Cladonia*; they have an important fastening and supporting function. More data about this subject are to be found in Sernander (1901), Galløe (1913) and Nienburg (1926).

Heteromerous. — The thallus in which the algal cells are confined to a narrow zone underneath the upper cortex is called heteromerous.

Homoiomerous. — When the gonidia are scattered throughout the medullary layer, the thallus is called homoiomerous.

Hymenium. — See under apothecium.

Hyphae. — Fungal cells, for the most part thread-shaped and colourless. According to the relative thickness of their cell-walls, the hyphae are called either leptodermatous, mesodermatous or pachydermatous. In leptodermatous hyphae, the wall is thinner than the lumen, whereas in pachydermatous it is thicker. In mesodermatous hyphae, wall and lumen have about the same thickness.

Hypothallus. — Every mycelial tissue, irrespective of its morphological meaning, is called hypothallus by Zukal (1895, p. 556) on the understanding that, under apparently favourable conditions, new thalli will develop on this tissue. In the term hypothallus Zukal comprises the concepts pro(to)thallus, "Flechtenmycel", hypothallinic appendices and myceliar margin. I do not follow Zukal in this definition but agree with Nienburg (1926, p. 69) who considers that the term hypothallus should be reserved for the spongy tissue at the underside of the thallus in *Anzia*, *Pannaria* and *Pannoparmelia* species. It consists of strongly anastomosing, very shortly articulated, thick-walled cells and is usually very dark-coloured.

Hypothecium. — See under apothecium.

Involucrellum. — See under perithecium.

Isidia. — Protuberances of the upper cortex are called isidia (Du Rietz, 1924, p. 381). They may be divided into autonomic and soredial isidia.

I. Autonomic isidia. All those isidia which are formed by mere protrusion of the cortex are called autonomic.

1. Warty isidia (isidia verruciformia, warzenförmige Isidien). The isidia only attain the size of small warts which do not seem to act as a means of dispersal, as they never break off. According to Du Rietz, warty isidia occur in a few lichens only, as for instance in *Parmelia aspera* (warts bearing a breathing pore) and in *Parmelia subaurifera* (warts developing soredia at their apex).

   In contradistinction to this author, however, I see no reason why any ordinary wart of the thallus should not be termed an isidium. Therefore, the number of species and forms, having warty isidia, may be somewhat extended (*Par-*

melia acetabulum var. *glomerata, Parmelia physodes* var. *subcrustacea* in certain cases; *Xanthoria parietina* var. *aureola,* etc.).

In some cases, the isidia being of the cylindric type, I have differentiated between isidia and warts as this greatly facilitates the description.

2. Cylindric isidia (isidia cylindrica, zylindrische Isidien). The isidia develop into shorter or longer outgrowths which remain simple or ramify. This type is the most frequent one. Examples are, among others, *Parmelia conspersa, fuliginosa, furfuracea, saxatilis, scortea, Sticta sylvatica* and several *Usnea* species. (In C. R. Acad. Sci., vol. 197, 1933, p. 695—697 Dughi describes an interesting case of propagation by isidia in *Parmelia scortea* var. *pastillifera* Harm.

   These isidia, characterised by a swollen body and a constricted base, bear apical rhizinae, and are reported to break off ultimately, giving rise to new thalli even on the mother-thallus. On account of their different structure and behaviour, Dughi regards these "papilles scortéales" different from the ordinary isidia.)
3. Club-shaped isidia (isidia claviformia, keulenförmige Isidien). The isidia develop into club-shaped or even foliaceous, emarginate, hollow bodies, most typically to be found in *Parmelia exasperatula.*
4. Scaly isidia (isidia squamiformia, schuppenförmige Isidien). The isidia develop into scales as in *Peltigera canina* var. *subcanina* and var. *rufescens* f. *praetextata.* As the scales in several cases tend to be leaf-like, it is hardly possible to draw a sharp line between them and the leafy isidia or the folioles such as frequently occur in foliose and fruticose lichens.
5. Coralloid isidia (isidia coralliformia, korallenförmige Isidien). The one feature these isidia have in common is that they are, at least partly, alternately incrassate and constricted, much like a pearl-chain. Otherwise, as pointed out by Du Rietz, they may differ in various ways. Some of them, for instance, may burst and become sorediose (some forms of *Cetraria glauca, Parmelia isidiotyla, Physcia nigricans, Xanthoria candelaria*), whereas in other species they do not produce soredia (*Umbilicaria pustulata*). There is no marked difference between these coralloid isidia and the more richly branched cylindric ones.

II. Sorediał isidia (isidia soredialia, sorediale Isidien). These isidia originate by the excrescence of soredia. At first they are warty, but, after increasing in length, they grow into cylindric, simple or furcate isidia. Good examples are *Lobaria pulmonaria, Physcia grisea, Usnea hirta.*

Isolateral. — Radially built, strap-shaped thalli of which both sides are entirely alike are called isolateral.

Lacinia. — Lobe.

Lecanorine. — The apothecium the margin of which is formed by the thallus is called lecanorine; lecanoroid is the word used by Frey.

Lecideine. — When in an apothecium the thalline margin is missing and the excipulum proprium is dark-coloured or even black and hard and brittle, the apothecium is called lecideine. See also apothecium.

Leptodermatous. — See under hyphae.

Lichen acids. — As a result of the symbiotic (or, perhaps, helotic) way of living, most lichens excrete waste products, among them the lichen acids. The literature about this subject is so extensive that I can only refer to Zopf's "Die Flechtenstoffe in chemischer, botanischer, pharmacologischer und technischer Beziehung" (1907). In this work the whole literature known up to 1907 has been cited. Later on, Fünfstück (1926, p. 35—46) wrote a compilatory part in Engler-Prantl's second edition.

It may incidentally be observed that in several cases pure cultures of lichen fungi or even algae are known to be able to produce lichen acids (see e. g. Quispel, 1943, p. 482—505).

Researches about lichen acids are, to an ever-increasing extent, being done by various scientists all over the world. The most valuable results so far have been attained by Asahina and his collaborators (1932—1941).

Much is to be expected, however, from the investigations by Curd & Robertson (in Journ. Chem. Soc. London), and by Kean & Nolan and their collaborators (in Sci. Proc. Roy. Dublin Soc.).

Lirellae. — Linear type of apothecia characteristic of *Graphidineae.*

Lumen. — Cavity of any cell.

Macaedium. — By this term the peculiar dusty mass is understood which clings to the disc of the apothecia of all *Coniocarpineae.* It consists of ripe spores, freed by the slimy disintegration of the asci, and of paraphyses which are usually lengthened so as to form a sort of capillitium.

Malaceoid venation. — See under veins.

Margin (proper). — See under apothecium.

Margin (thalline). — See under apothecium.

Medulla. — Hyphal tissue between the upper and lower cortex or, if there is no lower cortex extant, beneath the upper cortex only. It is quite analogous to the spongy parenchyma of the Phanerogams. See also thallus.

Mesodermatous. — See under hyphae.

Muriform. — Spores whose body is divided into a number of cells which resemble the bricks of a wall are called muriform. See also under apothecium.

Navel. — A central hold occurring, for instance, in *Umbilicaria.* See also under thallus.

Necral layer. — In several lichens (species of *Cetraria, Physcia, Umbilicaria*) the upper cortex is covered with a more or less horny stratum of dead hyphae the lumina of which are indistinct. Bachmann distinguishes an epi- and hyponecral layer in crustaceous lichens according to its occurrence above or below the gonidial zone.

Ostiolum. — See under perithecium and pycnid.

Pachydermatous. — See under hyphae.

Palisade plectenchyma. — See under plectenchyma.

Paraphyse. — See under apothecium.
Paraplectenchyma. — See under plectenchyma.
Perifulcrium. — See under pycnid.
Periphyse. — See under perithecium.
Perithecium. — The type of fruit, characteristic of the large group of *Ascolichenes* called *Pyrenocarpeae*. It is sessile, semi-immersed or fully immersed in the body of the lichen or even in the substratum. It consists of a hymenium more or less enclosed by the excipulum and is connected with the outside world through a narrow aperture — the ostiolum — only. The hymenium, comprising asci and paraphyses, is superposed on the colourless subhymenium. In some cases the paraphyses may be lacking or, in others, they may be present at first, becoming slimy later on, and disappearing (*Verrucaria*).

There are two main types of perithecia.

1. The entire type. The excipulum is spherical or pear-shaped, closed but for the ostiolum at the top, made up of a close and generally dark-coloured texture. Just as in the apothecium, the basal part is called hypothecium, whereas the ascending side-walls are called parathecium. This is the commonest type (fig. 6) prevailing in *Pyrenocarpeae*, but several variations may alter it. Near the ostiole, for instance, the parathecium may be fitted with a variously formed coal-black structure, the involucrellum. This form is met with in several species of *Verrucaria* (fig. 7). A minor variation is the perithecium at the inside of which periphyses grow near the ostiolum. These "hairs" are septate, simple or furcate hyphae arising from the parathecium proper or from a colourless layer between hymenium and parathecium. This form is to be found in *Dermatocarpaceae, Moriolaceae* and some *Verrucariae* (fig. 8).
2. The dimidiate type (*Pyrenulaceae*). The excipulum is semi-spherical or lenticular and flattened at the base. In either case the hypothecium is wanting in the centre (fig. 9). In this type, too, a carbonaceous involucrellum may be present but it is much stronger developed here and much more marked than the parathecium itself. Half-way down the base it is bent outward (fig. 10).

Phyllocladia. — This term has probably first been used by Magnusson (1926, p. 10) and later on it has been adopted by Frey (1933, p. 66).

Phyllocladia are those extremely varying parts of the *Stereocaulon* thallus that contain the gonidia; they are the stalked or sessile assimilatory organs of the lichen. As Magnusson describes them, they may be granular (of irregular grain-like shape), verrucose (somewhat regular, wart-like and flattened), coralloid (somewhat narrowly cylindrical), squamuliform (flattened and incised, irregular, crenate or sublobate), digitate (stalked and with short finger-like ends spreading in all directions), peltate (round and plane or even concave with darker centre), or foliaceous (with plane and broad leaf-like surface).

Plectenchyma. — This concept originates from Lindau (1899) and has been elaborated by Frey (1936). Any tissue of hyphae may be called plectenchyma and several kinds may be differentiated. The medullary plectenchyma, for instance, is the more primitive, being quite undifferentiated and built up of loosely arranged hyphae. Palisade plectenchyma is exclusively a cortical tissue consisting of hyphae perpendicular to the surface. Strand plectenchyma is a tough tissue of thick-walled, conglutinate, parallel fibres forming the central axis in *Stereocaulon* and *Usnea*, and the strengthening tissue in *Ramalina*. In scleroplectenchyma, the hyphae are thick-walled and, in addition, conglutinate; it occurs mainly in the cortex. Prosoplectenchyma is a cellular tissue with longish lumina, whereas paraplectenchyma have isodiametric lumina. The last-named tissue is frequently also called pseudoparenchymatous.

Podetium. — A simple, furcate or shrub-like branched stalk rising from a crustaceous, squamulose or foliaceous basal thallus. It is denudated or corticated and in the latter case possesses a smooth, sorediate, granular, squamulose or leafy cortex. It bears apothecia or pycnids, more rarely both of them, or it is quite sterile. According to Frey (1933, p. 8), it is habitally and morphologically a more or less uniform body which, in some cases, belongs more to the vegetative thallus in others more to the fruit. In *Baeomyces roseus*, for instance, the podetium is nothing but the excipulum of the apothecium. In other cases the identity is hardly to be traced; the subject has evoked much controversy (Baur, 1901; Nienburg, 1907; Sättler, 1914).

Polarilocular. — A term applied to a spore whose cells are placed at the opposite apices. See also under apothecium.

Polydactyloid venation. — See under veins.

Prosoplectenchyma. — See under plectenchyma.

Prothallus, protothallus. — Zukal (1895, p. 557) defines as prothallus or protothallus the tissue of hyphae that has originated from the germination of a spore or a pycnoconidium. It consists of thick, intensely coloured, dendritically branched, radiating hyphae and generally occurs in crustaceous lichens. Even in full-grown plants it often shows as a black border to the thallus proper which has developed upon it.

Pruina. — A powdery secretion. A thallus covered with this secretion is called pruinose.

Pseudocyphella. — A mere break in the cortex through which the medulla communicates with the open air (fig. 11). There is no question whatever of specialised cells lining the cavity, as in genuine cyphellae. Whereas the latter are confined to the genus *Sticta*, pseudocyphellae are common to a fair number of genera, e. g. *Alectoria, Cetraria, Cornicularia, Parmelia, Physcia, Ramalina* and others. Often they form useful systematic characters.

Pseudoparenchyma. — A term in the present paper replaced by paraplectenchyma, and resembling the parenchyma of the higher plants.

Pycnid, pycnide. — Pycnids, pycnides, pycnidia are minute conceptacles in which the pycnoconidia are formed. These organs have long been known under the name spermogonia (Tulasne, 1852; Nylander 1858—1860, 1862; Lindsay, 1859, 1870). It was, namely, supposed that they produced spermatia, male sexual cells. After Möller (1887) had proved to his own satisfaction these spermatia to be nothing but ineffective conidia, he called them pycnoconidia and, accordingly, the conceptacle in which they are formed a pycnid.

However, though apparently in certain cases the pycnoconidia have no fertilising function, this is by no means universally proved. Authors, looking upon the conidia as sterile spermatia, presumably are as much in the right as those who consider them fertile male cells, since they have been investigating quite different species and, thus, their results are not comparable. Stahl (1877), Vainio (1890), Baur (1898, 1901, 1904), Nienburg (1907) and Sättler (1914) hold the last view, whilst Fünfstück (1884) and Galløe (1927), amongst others, judge a fertilisation by spermatia unproved and unlikely.

A thorough knowledge of the anatomy of the pycnid is due to Glück (1899), whereas we owe the modern nomenclature to Steiner (1901).

Pycnids are visible as variously coloured, more often as blackish punctations which are either flush with the surface of the thallus (fig. 12 a) or embedded in the apex of a thallus wart (fig. 12 b). They may, in addition, project halfway out of the thallus (fig. 12 c) or be located at the tip of a spine (fig. 12 d). An example of this last-named type are the long-stalked pycnids in *Cetraria islandica.*

In a longitudinal section the pycnid is circular, pear-shaped or oblong. The wall, called perifulcrium, consists of one or more cell-layers and is colourless, reddish as in many *Cladonia* species or dark brown. The mouth or ostiolum is, as a rule, dark brown.

In some cases the inside of the perifulcrium is lined with the tissue that produces the conidia; it is made up of simple or richly branched, anastomosing hyphae (the fulcra after the nomenclature of Steiner), protruding radially to the centre of the cavity. In other cases, however, the interior of the pycnid is filled up with a dense tissue of more or less isodiametric cells between which space is left open for a system of tortuous canals along which the conidia escape.

With a single exception all fulcra are septate and divided into ordinary cells and basidia, the latter being distinguished by their bearing a conidium on the top or being attenuated into a bayonet-shaped point which is called sterigma and in its turn bears a conidium. A fulcrum is called exobasidial if only the terminal cells turn into basidia and produce pycnoconidia. If every cell is able to produce conidia, the fulcrum is termed endobasidial.

The pycnides show important anatomical differences and, according to Glück, 8 types may be distinguished.

1. *Peltigera*-type. The perifulcrium is lined, on the inside, with most primitive conidiophores, i.e. conidia-carriers which are composed of ordinary or basal cells only, bearing one or two basidia each. These are, to my mind incorrectly, called sterigmata too by Glück. On the tip of every basidium a single, large and ellipsoidal pycnoconidium is abstricted. Thus, the pycnoconidia are formed exobasidially.

2. *Psora*-type. Instead of a single basal cell, a septate fulcrum has developed with apical and lateral basidia. The cylindrical conidia are formed exobasidially.

3. *Cladonia*-type. This type is very much like the preceding one, but the fulcra are a little more differentiated and branched. The

basidia are often flask-shaped. The cylindrical pycnoconidia are formed exobasidially.

4. *Placodium*-type. Differing only from the preceding one by its most characteristic exobasidial pycnoconidia. They are very long and more or less hooked.

5. *Parmelia*-type. The fulcra develop into complicated anastomosing systems. The most important feature is that nearly all the cells bear a sterigma at the tip of which a mostly cylindrical conidium is abstricted. The conidia are formed endobasidially.

6. *Sticta*-type. The fulcra are partly discrete, protruding radially and freely to the centre of the pycnid, but partly, and especially near the circumference, they join so as to form a paraplectenchymatous tissue, enclosing small cavities in which also conidia are abstricted. The constituent cells of the fulcra are more or less isodiametric and thick-walled. Sterigmata are reduced to mere filiform stalks. Pycnoconidia are cylindrical and rather small and they are formed endobasidially.

7. *Physcia*-type. Principally the same as in the preceding one but the anastomosing parts of the hyphae have extended farther towards the centre of the pycnid. The sterigmata, too, are similar to those of the preceding type or still more reduced. The endobasidially formed pycnoconidia are small and always cylindrical. Glück apparently overlooked *Physcia ciliata* and *orbicularis*, whose conidia are fusiform and bulging.

8. *Endocarpon*-type. The cavity of the pycnid is to a still greater extent filled with a more compact tissue, leaving open only a few intercellular chambers. The cells lining the inside wall of these chambers are the basidia. Sterigmata and pycnoconidia do not differ from those of the *Physcia*-type.

As to the size and shape, the pycnoconidia may differ considerably; they may be straight or curved, cylindrical or ellipsoidal, very long and thin or short and rather broad. It has become customary to call certain exceptionally large conidia macroconidia or stylospores. Stylospore is a word first used by Tulasne (1852, p. 107): "propagules sporoïdes auxquels, dans les Champignons, j'ai donné le nom de stylospores, parce qu'ils naissent isolément sur des styles ou supports cylindriques simples et peu allongés". According to this definition it is difficult to see any difference between them and the conidia of, for instance, *Peltigera*. Indeed, in Engler-Prantl (1926, p. 191) the conidia of this genus are called macroconidia, though beside these Fünfstück also mentions ordinary pycnoconidia, without further details, however. In more recent times, too, macro- and pycnoconidia have been kept separate. Von Keissler (1938, p. 353), amongst others, mentions stylospores (= macroconidia) in *Porina glabra*. But I fail to see why these stylospores should be different from ordinary pycnoconidia. To be more precise, the "stylospores" of *Porina glabra* are 3—4 × 21—24 μ, whereas the pycnoconidia of *Pyrenula nitida* measure 0.5 × ± 20—40 μ! I do not consider the septa to be a character of the stylospores, in contrast to Von Keissler. In my opinion it would therefore be the best thing to discard the concepts stylospores and macroconidia, the more so as the ascospores which have a considerable range of variability with regard to shape, size and number of septa have never been thus differentiated.

Pycnoconidia. — See under pycnid.

Receptacle. — A rather vague term which, sometimes, is used for the hypothecium, sometimes for the whole amphithecium. See also under apothecium.

Rhizinae. — Fastening organs at the underside of foliaceous lichens. They vary considerably in shape and size as well as in anatomical structure, some of them being simple hyphae, others strands of hyphae and again others more differentiated "roots" composed of medulla and cortex.

It will be observed that the rhizinae in some *Physcia* species show transitional phases to cilia.

The tips of many rhizinae end brush-like, whilst in others they widen into a flat disc. In *Parmelia aspera* the rhizinae are at their tips surrounded by a drop of mucus which is believed to serve as an additional hold.

Especially in the genus *Peltigera* the rhizinae, as well as the veins, have attracted great attention but it was Gyelnik who was the first to see the importance of their appearance and to describe the 4 following types (1927, p. 124).

1. Rhizinae simplices are strong, simple hyphae. 2. Rhizinae fibrillosae are woolly-hirsute, 3. Rhizinae papposae have brush-like ends. 4. Rhizinae fasciculatae consist of hyphae more or less intertwined into strands.

Scleroplectenchyma. — See under plectenchyma.

Soralia. — According to the definition given by Du Rietz (1924, p. 376), soralia are those decorticated parts of the lichen-thallus which show an unusually strong increase of gonidia. This process results in the formation of soredia, i. e. small granular bodies that consist of gonidia spun round with short hyphae; they are the main dispersal organs, the diaspores, of many lichens.

As to the historical development of the concepts soralia and soredia, I may refer to Tobler (1925, p. 29—30) as well as to the important paper by Du Rietz (1924). To be sure, this author opposes — and not without reason — the words soral and soredium as used in the present sense, as being an unwarranted alteration of the original Acharian terminology. But these words have generally been adopted all the same, cf. for instance Magnusson (1926, p. 13, note) and Hillmann (1936, p. 13, note), and I would stand by the majority.

In his paper Du Rietz gives the following classification of the several types of soralia.

A. Diffuse soralia (soralia diffusa; diffuse Sorale). The upper surface is partly or wholly dissolved into a soredial mass (many *Cladonia* species as e. g. *Cl. bacillaris, digitata, fimbriata, glauca*).

B. Limited soralia (soralia limitata; begrenzte Sorale). The soralia are confined to small and, usually, well-defined spots.

I. Superficial, marginal and lateral soralia (soralia superficialia, marginalia et lateralia; flächen-, rand- und seitenständige Sorale). The soralia occur on the upper side or at the margin of foliaceous lichens and laterally on the branches of radially built, fruticose lichens.

1. Punctiform soralia (soralia punctiformia; Punktsorale). The soralia originate as very small, dot-shaped cracks in the upper cortex which, later on, usually may grow larger or even finally merge into a coherent soredial crust, resembling then a diffuse soral (*Parmelia bitteriana, revoluta, caperata, Usnea hirta*).

2. Maculiform soralia (soralia maculiformia, Fleckensorale). The soralia originate as roundish or oblong spots, somewhat larger than those of the preceding type, though the difference is not essential. They, too, may extend and unite into a sorediose crust (*Pertusaria amara, P. globulifera, Peltigera canina* var. *erumpens, Lobaria pulmonaria, Parmeliopsis ambigua, Parmelia dubia, Evernia prunastri, Physcia caesia, Ph. elaeina, Ph. orbicularis, Ramalina farinacea, Alectoria jubata, Usnea sorediifera*).

3. Fissure-shaped soralia (soralia rimiformia, Spaltensorale). The soralia originate as long and narrow cracks; they are rarely met with (*Parmelia sulcata*).

4. Marginal soralia (soralia limbiformia, Bortensorale). The soralia originate along the margin of a foliose thallus forming a coherent border (*Cetraria chlorophylla, C. pinastri, Parmelia dubia* f. *marginata, Physcia grisea*).

5. Cuff-shaped soralia (soralia maniciformia, Manschettensorale). This type occurs in *Menegazzia* only, a genus closely related to *Parmelia* but not represented in this country.

II. Terminal and subterminal soralia (soralia apicalia et subapicalia; spitzenständige Sorale). The soralia only occur at the tips of the lobes of dorsiventrally or radially built lichens.

6. Head-shaped soralia (soralia capitiformia; Kopfsorale). The soralia originate at the tip of inflated, dorsiventrally built lobes or at the end of radially built branches, looking much like small caps covering the thallus (*Parmelia tubulosa*).

7. False head-shaped soralia (soralia subcapitiformia; Halbkopfsorale). The soralia originate subterminally at the upper side of a dorsiventrally built, not inflated thallus. While growing, the tips may arch so as to form a helmet which, eventually, becomes crowned by the soral. At this stage it very much resembles the head-shaped soral (*Evernia prunastri* f. *capitata* [a form to be described in another paper], *Parmelia trichotera*; except for the latter none of the examples mentioned by Du Rietz are represented in Holland).

8. Lip-shaped soralia (soralia labriformia; Lippensorale). The soralia originate apically at the tip of the lobes of an isolaterally or dorsiventrally built thallus, splitting the ends into two lips. The upper lip usually curls upwards showing the whitish soredia (*Parmelia physodes, P. vittata, Physcia dubia, Ph. tenella, Ramalina pollinaria, Xanthoria substellaris*).

9. Helmet-shaped soralia (soralia forniciformia, Gewölbesorale). The soralia at first originate in the same way as the lip-shaped soralia but soon the upperlip gets strongly vaulted, forming a helmet at the

inside of which the soredia are produced (*Parmelia physodes.* var. *labrosa* f. *cassidiformis, Physcia adscendens*).

III. Isidial soralia (soralia isidialia; isidiale Sorale). The soralia originate by the bursting or breaking off of the tips of isidia (*Cetraria glauca, Parmelia bitteriana, P. subaurifera, Physcia astroidea, Ph. nigricans, Xanthoria candelaria*).

Soredia. — See under soralia.

Spore. — See under apothecium.

Sterigma. — See under pycnid.

Strand plectenchyma. — See under plectenchyma.

Strengthening tissue. — See under plectenchyma.

Stylospore. — See under pycnid.

Subhymenium. — See under apothecium.

Thallus. — The vegetative tissue made up of the two constituents of the lichen plant, fungus and alga, is called thallus. Within certain limits the thallus of every species has a fixed shape, but the stupendously great number of species, together with the extraordinary diversity of forms in which the thallus presents itself, first necessitated a rough subdivision into gelatinous, crustaceous, foliose and fruticose lichens. These concepts have, for a long time, lost their systematic meaning since several species of the same genus have been found to belong to the crustaceous and the foliose or the foliose and the fruticose group. The same specimen may even, in course of its development, pass from one group into another. For descriptive purposes, however, this division will keep its value.

In anatomical respect, we may distinguish thalli of which the form is determined by the alga and thalli in which the fungus is the formative factor. In the first case we may again distinguish two groups, viz. lichens with thread-like algae or with algae characterised by a mucous sheath.

Thread-like algae are known in *Coenogoniaceae* and *Ephebaceae* but these families are not represented in this country.

As to the algae with a mucous sheath, these belong entirely to the *Cyanophyceae, Nostoc* and *Gloeocapsa* being the more frequent genera. Thalli containing these algae as their gonidia frequently give the impression of being colonies of blue-greens penetrated by fungous hyphae. There is no question of any organisation of the framework, as mucus is almost the only building element, and hyphae and gonidia are scattered throughout the thallus. These plants are therefore characteristically called gelatinous lichens (*Collema*). A further phase of development is represented by those lichens in which the algae, situated near the outside of the thallus, divide to a greater extent and become more closely packed, so as to form a sort of cortex; examples of this type are not indigenous. The organisation may reach a still further specialisation, e. g. in the genus *Leptogium* in which upper and lower cortex are formed by the hyphae, the fungal element. Here we are dealing with a state approaching the foliose type of thallus which is mainly built up by the fungus.

The thalli in which the fungus is the formative element may be divided into three types: crustaceous, foliose and fructicose.

Crustaceous lichens are powdery or granulose, or again they are composed of more or less thick, dorsoventrally built, stratose crusts with their whole under surface so closely attached to the substratum, or even immersed in it, that they cannot without injury be detached.

Foliose lichens are, like the preceding type, dorsoventral expansions, but they are leaf-like, more or less deeply incised and their lobes, though as a rule firmly fastened to the subsoil, may be easily removed.

Fruticose lichens are usually attached to the substratum by a narrow base. They are dorsoventrally built and strap-like or still more often radially built and cylindrical, sometimes simple, mostly, however, fastigiate.

In fact, the *Cladoniaceae* form a group apart, since here a strongly negatively geotropic, cup- or trumpet-shaped or much branched stalk, called podetium, arises from a crustaceous, squamulose or foliaceous basal thallus. This structure which on its tip may bear apothecia and pycnids, is not in all cases to be looked upon as an ontogenetically homologous organ. At one time it is more an outgrowth of the thallus, consisting of both hyphae and algae, at another it belongs more to the fruit, being formed by the fungal element only (Frey, 1933, p. 1—9).

The attachment of the thallus to the substratum is very differently realised in various groups of lichens. The thallus may adhere to the substratum by the whole under surface, either immediately by the lower cortex or by the medulla as in gelatinous and crustaceous lichens or by means of the prothallus as is the case in crustaceous and a few foliose lichens. This prothallus or protothallus (Zukal, 1895, p. 557) is usually dark-coloured and often appears as a black border to the thallus; it is particularly conspicuous where individuals of the same or of different species are adjacent to each other.

Contact between lichen and substratum is frequently brought about by rhizinae. These are simple hyphae or bundles of them or root-like organs in which the tissue is differentiated into medulla and cortex.

Instead of rhizinae we find the under surface of the *Stictaceae* more or less densely covered with a hairy or felty coat by which the thallus is fixed to the substratum.

In some genera, taxonomically widely separated, such as *Dermatocarpon* (*Pyrenocarpeae*) and *Umbilicaria* (*Gymnocarpeae*), the thallus is firmly attached to the subsoil by a central navel which may be single or divided into a few strands.

An adhesive disc occurs in many fruticose lichens, e. g. in *Teloschistes* as well as in all *Usneaceae*.

Anatomically speaking, lichens are simple organisms. We already remarked that the thallus in various gelatinous lichens is wholly undifferentiated, as hyphae and gonidia are evenly scattered through the thallus, e. g. in *Collema*. In this case the thallus is called homoiomerous and, in addition, unstratified. In some other gelatinous lichens, however, such as *Leptogium*, the thallus is differentiated into an upper and a lower cortex and a medullary layer; it has, therefore, to be termed stratified, but it is still homoiomerous as the gonidia are scattered through the medulla. In the foliose lichens the thallus is also stratified, but there it is called heteromerous, since the gonidia are confined to a comparatively narrow zone underneath the upper cortex. Sometimes one of the layers is missing, as, for instance, the lower cortex in *Pannaria* and *Peltigera*, or, more rarely, the medulla which occasionally is the case in *Physcia* species. In epigenous crustaceous lichens — i. e. lichens growing fastened to their substratum — the lower cortex is much more frequently lacking. As to endogenous crustaceous lichens — i. e. lichens growing immersed in the substratum — there is not even a question of differentiation into a medullary and a cortical layer, all hyphae being more or less alike and the thallus being unstratified.

In fruticose lichens there occurs a new and characteristic element, the strengthening tissue. It consists of longitudinally stretched, thick-walled, conglutinate hyphae and may appear as an uninterrupted inner cortex or as separate strands (*Ramalina*) or as a firm chondroid central axis (*Usnea*).

Urceolate. — Refers to that type of apothecium which is more or less deeply immersed in the thallus, resembling a cup or an urn.

Veins. — The term veins refers to structures occurring on the lower surface of the thallus, being most conspicuous in *Peltigera*. In this genus a proper lower cortex is lacking, being replaced by the outermost zone of the medulla, a dense tissue of hyphae parallel to the surface. The lower surface may either be veined or the veins may have merged together into a coherent layer. Intermediate stages are also known. Now, the appearance of the underside, the venation and the shape of the veins are considered important taxonomical characters by Gyelnik (1927, p. 123). According to this author, there are two types of veins. The caninoid type in which the veins are well separated from the centre down to the tip of the lobes, narrow, and arched or, at least, markedly prominent (*Peltigera canina*); the polydactyloid type in which the veins are confluent near the tip of the lobes, rather broad, arched or perfectly flat, hardly or not prominent from the underside of the thallus (*Peltigera horizontalis, P. polydactyla*).

The type of under surface, devoid of veins or with a few whitish interstices faintly indicating a venation, is termed malaceoid (*Peltigera malacea, P. polydactyla* var. *polydactyloides*, a new combination to be published later on).

Warts. — See under wart-like isidia.

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TAXONOMICAL PART.

> *The point is, the systematist is not and never has been consistent...*
>
> W. H. Camp & C. L. Gilly in Brittonia, vol. 4, 1943, p. 372.

PARMELIACEAE.

A. Zahlbr. in Engler-Prantl, Die natürl. Pflanzenfam., vol. 1, pars 1*, 1907, p. 207 et ed. 2, vol. 8, 1926, p. 229; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 18.

Thallus generally foliaceous and dorsiventrally flattened, in a few cases only almost radially built, either closely appressed, or loosely adhering, or erect and fruticose, fixed to the substratum by means of rhizinae, by the prothallus or by wrinkles of the lower surface itself. Lobes stratified, with an upper cortex or with cortices both above and below. Gonidia bright green, belonging to the *Protococcaceae.* Medulla, except in *Candelaria* where it is barely discernable, more or less well-developed, usually white, more rarely yellow. *Apothecia* laminal, marginal or terminal, saucer-shaped, orbicular, sessile or shortly pedicellate, lecanoroid. Asci usually 6—8-spored, rarely containing more (up to 50 or even more in *Candelaria*). Spores colourless, 1-celled. Paraphyses simple or branched, frequently conglutinate. *Pycnidia* with endobasidial, more rarely exobasidial, fulcra (description after both Hillmann and Zahlbruckner).

Key to the genera.

(After Hillmann l. c.).

1a. Thallus very small, yellow, not altered by K. Apothecial disc almost concolorous with the thallus. Asci multisporous. Pycnidia with exobasidial fulcra 1. **Candelaria**
1b. Thallus different from above 2
  2a. Fulcra exobasidial. Medulla poorly developed . . . . 2. **Parmeliopsis**
  2b. Fulcra endobasidial. Medulla well-developed 3
    3a. Apothecia laminal. Pycnidia submerged in the thallus (marginal in a single species which is not indigenous). Thallus appressed to loosely adhering . . . . 3. **Parmelia**
    3b. Apothecia marginal or terminal. Pycnidia located in marginal warts or thorns. Thallus loosely adhering or upright and fruticose . 4. **Cetraria**

1. **CANDELARIA** Mass.

in Flora, vol. 35, 1852, p. 567; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 27; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 3;

vol. 8, 1932, p. 551 et vol. 10, 1940, p. 500 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 19.

Thallus microphyllous, growing in rosettes or irregularly wide-spreading, closely appressed or ascendent, fixed to the substratum by means of rhizinae, more or less deeply incised. Lobes dorsiventrally flattened, yellow, not reddened when treated with K, stratified, corticated. Upper cortex paraplectenchymatous, very thin. Gonidia bright green (*Chlorococcum* Fr.), arranged in clusters below the upper cortex. Medulla poorly developed or almost wanting, consisting of leptodermatous hyphae. Lower cortex similar to the upper one, thicker. *Apothecia* laminal, sessile, saucer-shaped, lecanoroid. Disc orbicular, brownish. Hypothecium colourless. Asci clavate, bulging, 20—50-spored or containing even more spores. Spores small, colourless, thin-walled, ellipsoidal, 1-celled but containing two large drops of oil, and thence appearing 2-celled. *Pycnids* laminal, rarely almost marginal, immersed in small warts. Perifulcrium colourless. Ostiolum yellow. Fulcra exobasidial, of the *Psora*-type. Pycnoconidia straight, ellipsoidal (description after Hillmann, l. c.).

One species in Holland.

1. **Candelaria concolor** (Dicks.) Stein in Cohn, Kryptog.-Fl. Schles., vol. 2, pars 2, 1879, p. 84; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 4; vol. 8, 1932, p. 551 et vol. 10, 1940, p. 500 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 20 — *Lichen concolor* Dicks., Fasc. Pl. Cryptog. Brit., vol. 3, 1793, p. 18 (non vidi) — *Candelaria vulgaris* Mass. in Flora, vol. 35, 1852, p. 568; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 27.

Macroscopical description. Thallus foliaceous, minute, growing in rosettes or irregularly wide-spreading, closely appressed, with ascending margins or with erect lobes, attached to the substratum by means of rhizinae, more or less deeply incised. Lobes flat or somewhat undulate, discrete or overlapping at the margins or clearly imbricate, about 1 mm long, 0.1—0.5 mm broad, irregularly incised to richly pinnately branched or digitate. Margins flat or ascending, entire or sorediate. Tips minutely incised, either broadened and fan-shaped or not. Upper side of the lobes chrome-yellow, citrine, vitellinous or greenish yellow, dull, smooth, without cortical ruptures and without isidia, sorediate. Soredia mainly marginal and terminal, sometimes also laminal, coarse-grained, yellow. Lower side of the lobes dirty white or reddish white, dull, smooth, with scattered, rather long, whitish, simple rhizinae. *Microscopical description.* Upper cortex colourless with yellow exterior zone, paraplectenchymatous, 1- or 2-layered, with large lumina, 12—18 μ. Gonidia bright green, spherical, 8—18 μ, arranged in clusters under the upper cortex, and almost reaching down to the lower cortex, frequently pushing away the medulla. Medulla, if any, very thinly plectenchymatous, up to 30 μ. Lower cortex colourless, paraplectenchymatous, (1—) 2—3-layered, with large lumina, 20—30 μ. *Apothecia* not observed in Holland. *Pycnides* extremely rare in this country, laminal, solitary or united into groups of 2 or 3, immersed in orange-coloured warts, spherical or pyriform, about 100 μ in diam. Perifulcrium colourless. Ostiolum yellow. Pycnoconidia colourless, ellipsoidal, ± 0.5 × 2—2.5 μ.

Chemical constituents and reactions. Cortex and medulla unaltered by K, C, KC, Pd. According to Zopf (Flechtenstoffe, 1907, p. 86, 90), the yellow colour of the cortex is due to stictaurin.

Ecology and frequency. Mainly arboricolous, preferring the more or less dusty base of way-side trees, and, therefore, considered to be nitrophilous. Presumably a somewhat uncommon species in view of the small number of recent finds.

Distribution. Occurs throughout Europe.

Remarks. Time and again *Xanthoria candelaria* and *Candelaria concolor* (to say nothing of *Candelariella vitellina* which is a crustaceous species) have been confused. Yet, they may be distinguished from each other, even in the field, in that specimens of the former either show a coarser or more erect habit, or present both features. At home, a drop of K immediately eliminates any doubt, since only in *Xanthoria candelaria* the upper surface is stained purple.

The variability of this species in Holland is less than abroad.

Key to the forms.

1a. Lobes appressed or with ascending margins, not hidden under soredial growth f. **laciniosa** (Duf.) Maas G.

1b. Lobes erect, strongly sorediate, looking like a sorediose crust f. **granulosa** (Leight.) A. Zahlbr.

f. **laciniosa** (Duf.) Maas G. nov. comb. — *Parmelia parietana* var. *laciniosa* Duf. in Fr., Lichenogr. Europ. Reform., 1831, p. 73.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 20, fig. 1; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 261, fig. sup.; Galløe, Natur. Hist. Danish Lich., vol. 5, 1936, tab. 32, fig. 164—166.

Lobes appressed or with ascending margins, more or less sorediate.

Remarks. I consider this form identical with the type of *Candelaria concolor*. The choice of the subdivisional epithet may need explanation. The first varietal names mentioned by Zahlbruckner (Cat. Lich. Univ., vol. 6, 1929, p. 6) for synonyms are var. *concolor* and var. *laciniosa*, both published by Fries in his Lichenographia Europaea Reformata, 1831, p. 73. Though this author considered them to belong to different groups, viz. “thallo nudo, haud pulverulento...” (var. *laciniosa*), and “subcrustacea, thalli marginibus pulverulentis...” (var. *concolor*), it is believed that these names refer to one and the same species. In this case the name *laciniosa* has place priority to *concolor*. It is quite understandable that Fries differentiated between “nude” and “pulverulent” (= sorediose) groups, as in some cases the soredia are difficult to discern indeed.

Overijsel: Kampen, *Bondam* (NBV); *Top* (NBV).

Gelderland: Bennekom, De Meent, 23 V 1943, *Maas G. 2469*, transition to f. *granulosa* (L); Doornspijk, 25 IV 1942, *Maas G. 1820* (L).

Utrecht: De Bilt, 1841, *Van der Sande Lacoste* (NBV); Bunnik, IV 1940, *Stafleu* (U); Utrecht, 1940, *Stafleu*, transition to f. *granulosa* (U); Utrecht, Oostbroek, 1 IV 1940, *Stafleu* (U); Vechten, 16 II 1941, *Stafleu* (U).

Noord-Holland: Haarlem, *Buse & Gildemeester-Buse* (L).

Zeeland: Zuid Beveland, *Van den Bosch* (NBV); Zuid Beveland, Ovezande, Noorddijk, 1844, *Van den Bosch*, transition to f. *granulosa* (NBV).

Noord-Brabant: Beek (?), VIII 1847, *Van den Bosch* (NBV).

f. **granulosa** (Leight.) A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 8

et vol. 8, 1932, p. 552 (ubi lit. et synon.) — *Lecanora candelaria* var. *granulosa* Leight., Lich. Fl. Great Brit., 1871, p. 182 (non vidi) — *Candelaria concolor* var. *granulosa* Mereschk., Lich. Ross. exs. no. 37, 1913, scheda (non vidi); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 23; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 500.

Lobes upright and strongly sorediate making the thallus look like a sorediose crust.

Overijsel: Hellendoorn, 26 VII 1941, *Maas G. 1280a* (L).

2. PARMELIOPSIS Nyl.

in Not. Sällsk. F. Fl. Fenn. Förh., vol. 5, 1861, p. 105; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 10; vol. 8, 1932, p. 552 et vol. 10, 1940, p. 500 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 25.

Thallus foliaceous, usually growing in rosettes, closely appressed, fixed to the substratum by means of rhizinae, incised. Lobes dorsiventrally flattened, stratified, corticated. Upper cortex palisade plectenchymatous. Gonidia bright green (*Chlorococcum* Fr.), arranged in clusters or in a continuous layer under the upper cortex. Medulla plectenchymatous, poorly developed, consisting of leptodermatous hyphae. Lower cortex more or less paraplectenchymatous. *Apothecia* laminal, lecanoroid, with orbicular disc. Asci 8-spored. Spores rather small, colourless, ellipsoidal or oblong, straight or falcate, 1-celled, thin-walled. *Pycnids* laminal and immersed, or marginal and almost stalked. Fulcra exobasidial. Pycnoconidia short and straight, or long and curved (description after Hillmann, l. c.).

Two species in Holland belonging to different sections.

Artificial key to the species.

1a. Upper side of the thallus yellow-green. Sorediate . . . **1. P. ambigua** (Wulf.) Nyl.
1b. Upper side light grey, isidiate. Isidia may burst and turn sorediose (in var. *vulnerata*) . . . . **2. P. aleurites** (Ach.) Lettau

Key to the sections.

1a. Pycnoconidia long, 12 μ or more, curved . . . . . sect. 1. CURVOCONIDIA
1b. Pycnoconidia short, 6 μ or less, straight . . . . . sect. 2. RECTOCONIDIA

Sectio 1. CURVOCONIDIA Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 27; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 501 (erroneously cited as *Curvogonidia*).

Pycnoconidia long, 12 μ or more, falcately curved.

1. Parmeliopsis ambigua (Wulf.) Nyl., Synops. Lich., vol. 2, 1863, p. 54[1]; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 10; vol. 8, 1932,

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[1] According to Hue (in Nouv. Arch. Mus., ser. 3, vol. 2, 1890, p. 217), this second fascicle of Synopsis methodica Lichenum was issued in 1888, contrary to the citations by Zahlbruckner and Hillmann!

p. 552 et vol. 10, 1940, p. 501 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 27 — *Lichen ambiguus* Wulf. in Jacquin, Collect. Bot., vol. 4, 1790, p. 239.

Macroscopical description. Thallus foliaceous, up to 5 cm in diam. (in Holland smaller, 1—2 cm), usually growing in rosettes, but adjacent individuals finally uniting, and covering larger patches, closely appressed to the substratum, and fixed to it by means of rhizinae, deeply incised. Lobes soft, thin, linear, 5—6 mm long, 0.5—1.0 mm broad, flat or slightly convex, more or less contiguous, or even overlapping, irregularly and somewhat richly branched. Margins flat or somewhat raised, entire or faintly and irregularly crenate. Tips slightly broadened, emarginate or incised. Upper side of the lobes yellow-green to grey-green, turning darker towards the centre, and somewhat tanned at the tips or with a narrow black zone, dull or faintly shiny, smooth, getting more dented or wrinkled towards the centre, usually minutely cracked, without isidia, sorediate. Soralia yellowish green, laminal and marginal, maculiform, more or less strongly vaulted. Lower side of the lobes black or brown-black, dull or somewhat shiny, irregularly and slightly veined, toward the tips, however, pale brown, shiny, smooth; beset with dark rhizinae which often extend up to the very margin. *Microscopical description.* Upper cortex yellowish, palisade plectenchymatous, 9—15 (—18) μ. Gonidia bright green, spherical, 9—14 μ, arranged in clusters of 15—45 μ. Medulla colourless, white in reflected light, rather thinly plectenchymatous, 45—60 μ. Lower cortex light brown, paraplectenchymatous, 1—2-layered, 9—12 μ. *Apothecium* found once only, laminal, sessile, saucer-shaped, 0.5 mm in diam. Amphithecium concolorous with the thallus, dull. Margin entire. Disc black-brown, dull. Internal structures and spores not examined owing to the scarcity of the material. *Pycnides* rare, scattered over the lobes, mainly located in the centre of the thallus, laminal, immersed, visible as black dots. Ostiolum brown. Pycnoconidia not observed.

Chemical constituents and reactions. Upper cortex K — or + faintly yellow, C —, KC + yellow, Pd —. Medulla indifferent.

Ecology and frequency. On coniferous and deciduous trees, predominantly on birches in a fire break, sheltered from desiccating winds by some adjacent parcel of wood. Not uncommon in central Holland, but easily overlooked.

Distribution. Most probably occurring throughout Europe, especially common in moist mountainous regions.

Remarks. The specimens indigenous in Holland remain small, rarely attaining 2 cm across, in contrast to those growing under more favourable conditions of humidity in the mountainous regions of Europe, a fact already observed by Erichsen (in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 8): "Auch die bei uns im Flachlande in der Regel an altem Holz wachsende Hauptform weicht durch mehr gedrungenen Wuchs und blassgelbliche Färbung von den Gebirgsformen ab". On the same page, Erichsen described a var. *fagicola*, differing from the "Hauptform" (= f. *ochromatica*) in that its lobes and soralia are grey-green. In my opinion, the difference does not extend to so important characters that *fagicola* deserves varietal rank. It seems to be a mere umbrose form. Evidently, Zahlbruckner (Cat. Lich. Univ., vol. 8, 1932, p. 552) who held the same view intended to make the combination f. *fagicola* (Erichs.) A. Zahlbr., but failed to observe that Erichsen had described his *fagicola* as a variety to *P. ambigua*, not to *P. aleurites*.

Only a few varieties or forms have been differentiated, two of which are known to occur in Holland.

Key to the forms.

1a. Lobes clearly visible, not consumed by soredial production . . . **f. ochromatica** (Wallr.) Maas G.

1b. Except for a few circumferential lobes, all of the thallus converted into a sorediose mass . . . . **f. leprosa** Anders

f. **ochromatica** (Wallr.) Maas G. nov. comb. — *Parmelia diffusa* var. *ochromatica* Wallr., Fl. Cryptog. German., vol. 3, 1831, p. 497.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 20, fig. 2 and 3; Cretzoiu in Inst. Cercetar. Experim. Forest., ser. 2, vol. 47, 1941, tab. 5, fig. 2; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 41; Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 2, fig. 11; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 20, fig. 1; Riddle in Bryologist, vol. 20, 1917, tab. 20, fig. 4; Wulf. in Jacquin, Collect. Bot., vol. 4, 1790, tab. 4, fig. 2.

Soralia scattered near the circumference of the thallus, more crowded, and eventually confluent in the centre.

Remarks. This form I consider identical with the type of *Parmeliopsis ambigua*.

Gelderland: Bennekom, 6 IX 1942, *Maas G. 2203* (L); Bennekom, Oostereng, 9 IV 1944, *Maas G. 2995* (L); Drempt-Hoog Keppel, Ulenpas, 13 VI 1943, *Maas G. 2568* (L); Ellekom, Hagenau, 13 VI 1943, *Maas G. 2537, 2550* (L); Ellekom, De Steenkuilen, 14 VI 1943, *Maas G. 2583*, transition to f. *leprosa* (L); Hoenderloo-Beekbergen, Spelderholt, 28 III 1943, *Maas G. 2375* (L); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2369* (L); Speulde, 28 V 1939, *Nannenga 829* (Nga).

Noord-Brabant: Oisterwijk, Logtsche heide, 23 VII 1943, *Maas G. 2610* (L).

Limburg: Epen, Eperheide, 24 VI 1942, *Maas G. 1959* (L); Epen-Holset, Kerperbosch, 13 VII 1942, *Maas G. 2021*, c. ap. (L); Epen-Holset, Malensbosch, 23 VI 1942, *Maas G. 1957* (L).

f. **leprosa** Anders in Hedwigia, vol. 64, 1923, p. 265; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 13 — *Parmeliopsis ambigua* f. *lepraria* Anders, Strauch- u. Laubfl. Mitteleurop., 1928, p. 136; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 552 — *Parmeliopsis ambigua* var. *leprosa*; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 30; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 501.

Soralia confluent and converting almost the whole of the thallus into a sorediose crust except for some few lobes at the circumference.

Gelderland: Ellekom, De Steenkuilen, 14 VI 1943, *Maas G. 2582* (L).

Sectio 2. RECTOCONIDIA Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 36; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 501 (erroneously mentioned as Rectogonidia).

Pycnoconidia short, usually less than 6 μ, straight.

2. **Parmeliopsis aleurites** (Ach.) Lettau in Hedwigia, vol. 52, 1912, p. 228 — *Lichen aleurites* Ach., Lichenogr. Suec. Prodr., 1798, p. 117 — *Parmeliopsis pallescens* (Hoffm.) A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 15; vol. 8, 1932, p. 552 et vol. 10, 1940, p. 502 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 36.

Macroscopical description. Thallus foliaceous, growing in rosettes, up to 8 cm in diam., attached to the substratum by means of rhizinae, and except for the margins adnate, more or less deeply incised. Lobes somewhat rigid, of variable length, 4—10 mm long or even more, 0.5—2 mm broad, flat or somewhat wavy, discrete, contiguous or overlapping, irregularly branched. Margins flat or somewhat ascending, entire or slightly and irregularly crenate or sinuate. Tips often broadened, up to 3 mm broad, crenate or incised. Upper side of the lobes light or dark grey, dull, shiny at the tips, and here sometimes somewhat tanned, smooth or a little rough, dented towards the centre, isidiate. Isidia laminal and marginal, wart-like to cylindrical, concolorous with the thallus or tanned at their apices, sometimes bursting and becoming sorediose. Lower side of the lobes white or pale brown, dull or faintly shiny, smooth or dented, with scattered, dirty white or dark brown, short, unbranched rhizinae.

Microscopical description. Upper cortex colourless, built up of palisade plectenchyma, consisting of short-celled hyphae, 5—20 μ. Below this layer and more towards the centre of the thallus sometimes a second and more paraplectenchymatous one may be discerned. Gonidia bright green, 7—15 μ, spherical, arranged in clusters or in a continuous layer, and deeply penetrating into the upper cortex. Medulla colourless, white in reflected light, thinly to somewhat densely plectenchymatous, 45—120 μ. Lower cortex colourless or brownish, paraplectenchymatous, 9—18 μ. *Apothecia* and *pycnides* not observed.

Chemical constituents and reactions. Upper cortex and medulla K + immediately yellow, then red-brown, C —, KC + orange-brown, Pd + yellow, turning orange-red. Zopf (Flechtenstoffe, 1907, p. 226, 275, and 416) mentions the presence of atranorin ($C_{19}H_{18}O_8$) and lobaric acid ($C_{24}H_{26}O_8$). Asahina and Nonomura (in Ber. Deutsch. Chem. Ges., vol. 68 B, 1935, p. 1698—1704) propose the formula $C_{25}H_{28}O_8$ for lobaric acid, this being more in accordance with the results of their analytical investigations.

Ecology. Lignicolous and arboricolous, but mainly preferring such *Coniferae* as *Pinus* and *Picea*.

Distribution. Much like the preceding species, *P. aleurites* is in all probability distributed all over Europe. As Hillmann (l. c. p. 29) states, it is in the lowlands a regular companion to *P. ambigua*. Remarkably enough, it is not recorded from Belgium (see Duvigneaud & Giltay in Bull. Soc. Roy. Bot. Belg., vol. 70, 1938, Suppl.).

Remarks. As has been rightly pointed out by Degelius (in Bergens Mus. Årb., naturvidensk. rekke, [1934] 1935, no. 3, p. 23), *pallescens* as used by Zahlbruckner and Hillmann is untenable for a specific epithet.

Hillmann in his description reports on the upper side being "schwammig-flockig", and in a foot-note proceeds saying "Am besten unter dem

Mikroskop bei etwa hundertfacher Vergrösserung und bei auffallendem Lichte zu sehen. — Diese schwammig-flockige Oberfläche gibt ein gutes Unterscheidungsmerkmal gegenüber *Parmeliopsis hyperopta,* die oberseits glatt ist". Obviously, the appearance of the upper side is brought about by the quality of the upper cortex which consists of a palisade plectenchyma. The cell-rows of this tissue may loosen, or the short cells themselves may become detached, either of which possibilities may give rise to the somewhat fluffy appearance of the surface.

Key to variety and form.

1a. Thallus densely isidiate; isidia covering almost the whole of the thallus
var. **albescens** (Wahlbg.) Maas G. f. **pityreiformis** (Bartl. et Hampe ex Hillm.) Maas G.
1b. Thallus more or less isidiate; isidia becoming sorediose
var. **vulnerata** (Hillm.) Maas G.

var. **albescens** (Wahlbg.) Maas G. nov. comb. — *Lichen ambiguus* var. *albescens* Wahlbg., Fl. Suec., vol. 2, 1826, p. 818.

Isidia more or less crowded.

Remarks. It is not the description Wahlenberg gave of his var. *albescens* ("scutellis saturatius fuscis"), but rather its name which suggests that the colour of this variety is different from that of *Parmeliopsis ambigua.* It is, therefore, in consequence of the view held by Zahlbruckner (Cat. Lich. Univ., vol. 6, 1929, p. 17) who assumes var. *albescens* to be synonymous with *Parmeliopsis aleurites,* that I consider this variety more or less closely resembling the type of *Lichen aleurites.* It shows minor variations, however, one of which (f. *pityreiformis*) is characterised by its densely packed isidia. For specimens showing no differences from the authentic *Parmeliopsis aleurites* worth speaking of, I hereby propose the name f. **eu-albescens** Maas G. nov. f. This forma is characterised by its isidia which are small, wart-like and scattered at the tips of the lobes, but grow more crowded and elongated towards the centre of the thallus (isidia parva, verruciformia, sparsa in loborum apicibus, elongata et conferta in media thalli parte). For the iconography of this form I may mention: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 20, fig. 4; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 51, fig. sup.; Riddle in Bryologist, vol. 20, 1917, tab. 20, fig. 2; Smith et Sowerb., Engl. Bot., vol. 12, 1801, tab. 858. No such specimens have as yet been collected in Holland. I am, however, convinced that more of this beautiful species will eventually be found, particularly in the eastern provinces and in the Frisian Islands, the more so since it has been recorded from neighbouring German regions.

var. **albescens** f. **pityreiformis** (Bartl. et Hampe ex Hillm.) Maas G. nov. comb. — *Parmelia tiliacea* var. *pityreiformis* Bartl. et Hampe ex Hillm. in Rep. spec. nov. regn. veg., vol. 33, 1933, p. 173 — *Parmeliopsis pallescens* var. *pityreiformis* (Bartl. et Hampe) Hillm. in Rep. spec. nov. regn. veg., vol.. 33, 1933, p. 173 et in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 39; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 502.

Isidia densely packed, covering almost the whole of the thallus, making it look like a uniform, areolate crust, only a few lobes being visible at the circumference.

Remarks. Hillmann rightly observes that this form somewhat resembles a strongly sorediose *Physcia grisea*. Forma *pityreiformis* may, however, be recognised in that it has no soredia but isidia instead, and that its cortex as well as its medulla react with a yellow colour upon K.

Another *Physcia* to which this form shows much resemblance is *Ph. astroidea* for which I indeed mistook it at first sight. Since neither apothecia nor pycnidia are to be expected in Holland, we must rely upon other distinguishing characters. A safe distinguishing feature is the texture of both upper and lower cortices which are exactly reversed. In *Parmeliopsis aleurites* the upper cortex consists of palisade plectenchyma, the lower cortex being paraplectenchymatous. In *Physcia astroidea* they are paraplectenchymatous, and densely plectenchymatous respectively. In the field, too, it is possible with practice to tell both species apart. In *aleurites* — and, of course, the same holds for its forms or varieties — the marginal lobes are not so closely appressed to the substratum as in *Physcia astroidea*. On the whole, the lobes of *Parmeliopsis aleurites* do not show that typical *Physcia*-like appearance one becomes familiar with in the field which is not apparent from the written descriptions.

Gelderland: Doornspijk, Nieuw Soerel, 25 IV 1942, *Maas G. & van Soest* (L, VS).

Utrecht: De Vuursche, 3 VII 1934, *Nannenga 367a* (Nga).

var. **vulnerata** (Hillm.) Maas G. nov. comb. — *Parmeliopsis pallescens* var. *vulnerata* Hillm. in Verh. Bot. Ver. Prov. Brandenburg, vol. 74, 1933, p. 123 et in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 39; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 502.

Isidia largely in the middle of the thallus, bursting at their apices, and turning into white farinose soredia.

Utrecht: De Vuursche, 3 VII 1934, *Nannenga 367b* (Nga).

3. **PARMELIA** Ach. em. De Not.

in Giorn. Bot. Ital., vol. 2, pars 2, 1847, p. 189 (non vidi); Ach., Meth. Lich., 1803, p. 153 (pro min. parte); Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 123; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 20; vol. 8, 1932, p. 552 et vol. 10, 1940, p. 503 (ubi lit. et synon.); Hillm. in Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 42 — *Imbricaria* Ach. in Kgl. Vetensk. Akad. Nya Handl., vol. 15, 1794, p. 250 (pro parte); Abeleven in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 16.

Thallus foliaceous, varying from loosely adhering to firmly attached, fixed to the substratum by means of rhizinae or by the lower cortex, incised. Lobes dorsiventrally flattened or almost radially built, variously shaped, from closely attached to ascending, stratified, corticated. Upper cortex paraplectenchymatous, arising from hyphae perpendicular to the surface Gonidia bright green (*Chlorococcum* Fr.), arranged in clusters or in a layer under the upper cortex. Medulla plectenchymatous, continuous or excavate, white. Lower cortex paraplectenchymatous. *Apothecia* laminal, sessile or shortly pedicellate, saucer-shaped, lecanoroid. Hypothecium colourless, with gonidia underneath. Asci 2—8-spored. Spores colourless, 1-celled, ellipsoidal to spherical. *Pycnids,* with one exception (*Parmelia baumgartneri*), laminal, sometimes immersed in the apothecial margin, either immersed in the thallus or protruding, with black ostiolum. Fulcra endobasidial. Pycnoconidia colourless, straight, cylindrical or fusiform or somewhat constricted in the middle, and, accordingly, bifusiform (description partly after Hillmann l. c.).

Remarks. Apart from 4 species which are considered lost for the native flora, 22 species have been dealt with here.

It should be remembered that most *Parmeliae* change colour when moistened, so that they should be treated in dry condition; the key always refers to that condition.

Artificial key to the species.

1a. Thallus neither sorediate nor isidiate, upper surface smooth or, at most, strongly wrinkled (sometimes pycnidia are immersed in prominent warts which should not be confused with ordinary warts or isidia) 2
  2a. Upper side of the lobes dark grey-green, olive-green, or brown . . . 3
    3a. Medulla Pd + yellow changing into orange. Thallus making a coarse appearance, lobes up to 8 mm broad . **6. P. acetabulum** (Neck.) Duby
    3b. Medulla Pd —. Thallus more graceful in appearance, lobes at most 3 mm broad 4
      4a. Medulla C + red. Corticolous **12. P. fuliginosa** (Fr.) Nyl. var. **glabratula** (Lamy) Oliv.
      4b. Medulla C —. Saxicolous . . . . **7. P. prolixa** (Ach.) Malbr.
  2b. Upper side of the lobes of a different colour 5
    5a. Upper side grey in various shades 6
      6a. Lobes faintly reticulately dented, and pseudocyphellate some forms of **23. P. sulcata** Tayl.
      6b. Lobes without reticulate dents, and epseudocyphellate . . . 7
        7a. Lower side of the thallus provided with rhizinae . . . 8
          8a. Thallus more or less appressed, margins of the lobes flat. Lower surface rhizinose up to the tips of the lobes **18. P. quercina** (Willd.) Vain.
          8b. Thallus somewhat loosely adhering, margins of the lobes frequently raised. Lower surface usually having a broad bare terminal zone **26. P. trichotera** Hue f. **munda** Harm.
        7b. Lower side of the thallus without rhizinae, wrinkled some forms of **2. P. physodes** (L.) Ach.
    5b. Upper side yellow-green or grey-green 9
      9a. Lower side with rhizinae reaching up to the very tips, or leaving open a narrow bare zone. Lobes richly branched, narrow, up to 5 mm broad . . . . **16. P. conspersa** (Ehrh.) Ach.
      9b. Lower side with a broad bare terminal zone. Lobes moderately branched or incised, broad, up to 10—15 mm broad **24. P. caperata** (L.) Ach.

1b. Thallus isidiate or sorediate (species displaying both isidia and soredia may be traced by following the key from 10a as well as from 10b onward) . . 10
  10a. Thallus isidiate, i. e. with small warts, inflated papillae, or various kinds of isidia 11
    11a. Upper side of the lobes grey 12
      12a. Thallus foliaceous to almost fruticose. Lower side of the lobes partly canaliculate, entirely black or with carneous or vinaceous shades or partly white, sparingly rhizinose **5. P. furfuracea** (L.) Ach.
      12b. Thallus foliaceous, not as above 13

13a. Lower side rhizinose. Medulla continuous. Lobes esorediate . 14

14a. Lobes reticulately dented, pseudocyphellate. Medulla Pd + yellow, changing into orange, C — **19. P. saxatilis** (L.) Ach.

14b. Lobes without reticulations, and without pseudocyphellae. Medulla Pd + yellowish, C + red . **20. P. scortea** Ach.

13b. Lower side entirely without rhizinae, inflated and wrinkled. Medulla excavated (medullary cavity is shown when a lobe is cut off). Lobes with terminal lip-shaped soralia **2. P. physodes** (L.) Ach. var. **subcrustacea** (Flot. ex Körb.) Hillm.

11b. Upper side of the lobes not grey 15

15a. Upper side yellow-brown, dark brown, or olive-green . . . 16

16a. Lower side whitish or pale brown 17

17a. Isidia especially in the centre of the thallus more or less crowded, cylindrical and usually branched **11. P. elegantula** (A. Zahlbr.) Szat.

17b. Isidia different 18

18a. Warts confined to the tips of the lobes, developing into folioles towards the centre. Margins strongly crenulate or beset with folioles. Lower cortex thinner than the upper one **9. P. laciniatula** (Flag.) A. Zahlbr.

18b. Warts occurring all over the thallus, developing into clavate or spatulate isidia. Margins of the lobes more or less crenulate, but not beset with folioles. Lower cortex thicker than the upper one **10. P. exasperatula** Nyl.

16b. Lower side black, turning brown at the tips 19

19a. Medulla C — 20

20a. Medulla Pd — 21

21a. Isidia eventually bursting at their apices, and becoming sorediose. Saxicolous species . . . 22

22a. Lobes olive-brown. Margins entire or slightly crenate . . . . . **13. P. isidiotyla** Nyl.

22b. Lobes darker, almost black. Margins more minutely incised . . **14. P. disjuncta** Erichs.

21b. Isidia wart-like, with indented or perforated apices, never turning sorediose. Almost exclusively arboricolous . . . . **8. P. aspera** Mass.

20b. Medulla Pd + yellow, turning orange. Thallus for the greater part strongly wrinkled or covered with warts **6. P. acetabulum** (Neck.) Duby var. **glomerata** Hillm.

19b. Medulla C + red 23

23a. Part of the isidia burst, and become sorediose **15. P. subaurifera** Nyl.

23b. None of the isidia become sorediose, though they do break off easily, showing their white medulla **12. P. fuliginosa** (Fr.) Nyl.

15b. Upper side yellow-green 24

24a. Lower side rhizinose up to the very tips or with a narrow bare terminal zone. Lobes richly branched, narrow, up to 5 mm broad . . . . **16. P. conspersa** (Ehrh.) Ach.

24b. Lower side with a broad bare terminal zone. Lobes moderately branched or incised, broad, up to 10—15 mm broad **24. P. caperata** (L.) Ach.

10b. Thallus sorediate 25

25a. Upper side of the lobes grey or grey-green, but in this case the grey colour is dominant 26

26a. Lower side without rhizinae. Medulla excavate 27
  27a. Medulla Pd — or + yellowish 28
    28a. Lobes at all events with terminal soralia 29
      29a. Soralia lip-shaped. Lobes for the greater part distinctly flat. Tips of the soraliferous lobes perforated
        3. **P. vittata** (Ach.) Nyl.
      29b. Soralia head-shaped (soralia capitiformia). Lobes distinctly convex. Tips of the soraliferous lobes closed
        4. **P. tubulosa** (Schaer.) Bitt.
    28b. Soralia never located at the tips of the lobes, but arising from the crests of rugosities in the centre of the thallus
      1. **P. bitteriana** A. Zahlbr.
  27b. Medulla Pd + yellow, turning into orange. Lobes with terminal lip-shaped soralia . . . . 2. **P. physodes** (L.) Ach.
26b. Lower side rhizinose. Medulla continuous 30
  30a. Medulla C + red 31
    31a. Soralia white, laminal and marginal, in the beginning sharply limited, starting as small dots, finally more or less confluent. Lower side pale brown or whitish
      21. **P. dubia** (Wulf.) Schaer.
    31b. Soralia greyish, terminal or subterminal, somewhat dispersed. Lower side black, passing into brown towards the tips
      22. **P. revoluta** Flk.
  30b. Medulla C — 32
    32a. Lobes pseudocyphellate. Soralia rimiform, laminal and marginal . . . . 23. **P. sulcata** Tayl.
    32b. Lobes without pseudocyphellae. Soralia of the false head-shaped type (soralia subcapitiformia), marginal
      26. **P. trichotera** Hue.
25b. Upper side of the lobes not grey 33
  33a. Upper side yellow-brown, olive-green to dark brown . . . 34
    34a. Medulla C —. Almost exclusively saxicolous 35
      35a. Lobes olive-brown. Margins entire or slightly crenate
        13. **P. isidiotyla** Nyl.
      35b. Lobes darker, almost black. Margins more minutely incised
        14. **P. disjuncta** Erichs.
    34b. Medulla C + red. Arboricolous or at least on wood
      15. **P. subaurifera** Nyl.
  33b. Upper side yellow-green or grey-green, the green colour always being dominant 36
    36a. Thallus medium-sized to large, attaining a diameter of at least 5 cm, often more. Lobes loosely adhering 37
      37a. Lobes without pseudocyphellae. Medulla C —
        24. **P. caperata** (L.) Ach.
      37b. Lobes pseudocyphellate. Medulla C + red
        25. **P. andreana** Müll. Arg.
    36b. Thallus minute, about 1 cm across. Lobes tightly appressed
      17. **P. mougeotii** Schaer.

Key to the subgenera.

1a. Lower side of the thallus more or less wrinkled, without rhizinae
  subgen. 1. HYPOGYMNIA
1b. Lower side of the thallus provided with rhizinae (the species in this subgenus which are almost devoid of rhizinae do not occur in Holland)
  subgen. 2. EUPARMELIA

Subgenus 1. HYPOGYMNIA Nyl.

in Flora, vol. 64, 1881, p. 537; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 24 et vol. 10, 1940, p. 503 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 50.

Lower side of the thallus without rhizinae, wrinkled. Medulla lacunose or not. Spores less than 10 μ long.

One section only in Holland.

Sectio 1. TUBULOSAE Bitt.

in Hedwigia, vol. 40, 1901, p. 172, 199; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 24 et vol. 10, 1940, p. 503 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 51.

Medulla lacunose or excavate.

Key to the subsections.

1a. Soredia laminal, more or less covering the whole of the thallus, not formed in well-defined soralia . . . . . subsect. 1. Diffuso-sorediosae

1b. Soredia mainly developed in well-defined terminal soralia, but occasionally also laminal . . . . subsect. 2. Soraliferae

Subsectio 1. Diffuso-sorediosae Bitt.

in Hedwigia, vol. 40, 1901, p. 173, 199; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 51; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 503.

Soredia laminal, not confined to circumscribed spots, but developing more or less all over the upper surface except at the tips of the lobes.

Remarks. Etymologically speaking. *Diffuso-sorediosae,* as written by Zahlbruckner, is more correct than the original *Diffuse-sorediosae* by Bitter.

1. Parmelia bitteriana A. Zahlbr. in Verh. Zool.-Bot. Ges. Wien, vol. 76, 1927, p. 95; idem, Cat. Lich. Univ., vol. 6, 1929, p. 26; vol. 8, 1932, p. 554 et vol. 10, 1940, p. 507 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 51.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 21, fig. 4; Bitter in Hedwigia, vol. 40, 1901, tab. 10, fig. 8; Schulz—Korth in Rep. spec. nov. regn. veg. Beih., vol. 67, 1931, tab. 11, fig. 21; Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 1, fig. 2.

Macroscopical description. Thallus foliaceous, growing in rosettes, up to 8 cm in diam., attached to the substratum by means of the lower surface, and by a few haustoria, deeply incised. Lobes soft, variously shaped, long and narrow, or short and broad, up to 1 or 2 cm long, 1—3 mm broad, usually contiguous, but also partly discrete, and partly overlapping, more or less richly and pinnately branched, flat or convex at the tips, convex or irregularly wavy in the centre. Margins entire. Tips broadened or not, somewhat raised and inflated, rounded or lobate or incised. Upper side grey except for a narrow tanned zone along the tip of the lobes, dull or faintly shiny, smooth at the tips, turning rugose or warty toward the centre, sorediate. Soredia greyish or whitish, arising on the crests of the rugosities, more and more uniting into a continuous or areolate soredial mass. Lower side of the lobes black, dull and wrinkled or folded in the centre of the thallus, dark or pale brown, shiny and inflated at the tips, without rhizinae. *Microscopical description.* Upper cortex colourless, paraplectenchymatous, about 21 μ. Gonidia bright green, spherical, 10—12 μ, arranged in a continuous layer of about 30 μ. Medulla colourless, white in reflected light, more or less densely plectenchymatous, detaching from the lower cortex, about 120 μ. Lower cortex dark brown, paraplectenchymatous, 1- or 2-layered, 9—12 μ. *Apothecia* and *pycnidia* not observed.

Chemical constituents and reactions. Upper cortex K + yellow, slowly turning brown-red, C —, KC + brown-red, Pd —. Medulla K + yellow, C — or + yellowish, KC + orange-brown, Pd + slowly yellow or greenish yellow. As stated by Zopf (Flechtenstoffe, 1907, p. 226, 282, 419), the species contains atranorin ($C_{19}H_{18}O_8$), and farinaceic acid ($C_{26}H_{32}O_8$).

Ecology and frequency. On deciduous and coniferous trees. Though *P. bitteriana* has certainly always been an extremely rare species in the Netherlands, there still exists the possibility that it has been overlooked on account of its resemblance to *P. physodes* in association with which it usually occurs.

Distribution. The distribution of this species in Europe is still uncertain. According to the literature available, it is lacking in Albania, Belgium, Bulgaria, Great Britain, Greece, Italy, Luxemburg, Poland, U. S. S. R. (except in the republic of Lithuania), and Yugoslavia.

Remarks. It differs from *P. physodes* in its reaction to Pd, and in its servediose upper surface. From *P. tubulosa* f. *farinosa* it may be distinguished by the tips of the lobes which, in this form, are mealy-sorediose.

Gelderland: Bennekom, *Buse & Buse-Koppiers* (L).

Subsectio 2. Soraliferae Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 56; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 503.

Soralia more or less well-defined, terminal.

Key to the series.

1a. Terminal ends of the soraliferous lobes split up so that the medullary cavity directly communicates with the open air. Soralia lip-shaped, and usually curved upwards . . . . ser. 1. *Labroso-soraliferae*

1b. Terminal ends of the soraliferous lobes closed, at most somewhat indented. Soralia head-shaped . . . . ser. 2. *Capitato-soraliferae*

Series 1. *Labroso-soraliferae* (Bitt.) Hillm.

in Rabenh. Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 57; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 503 — *Labrose-soraliferae* Bitt. in Hedwigia, vol. 40, 1901, p. 174, 218.

Soralia more or less distinctly lip-shaped. The apices of the lobes split horizontally, usually between upper and lower cortex, forming two lips which grow apart. The upper lip is the larger one, and its lower surface is transformed in the soralium.

Remarks. Neither Bitter nor Hillmann are very precise as to their nomenclature, but it is quite evident that the *Labroso-soraliferae* of Hillmann (and so it is with his *Capitato-soraliferae*) are subordinate to those originally intended by Bitter. This is why I have cited the last-named author between brackets.

Key to the species.

1a. Medulla and soralia Pd + immediately yellow, then turning orange. Upper side more or less convex. Lower side hardly or not visible from above
2. P. physodes (L.) Ach.

1b. Medulla and soralia Pd — or + slowly yellow-green. Upper side flat. Lower side visible from above as a black margin along the lobes
3. P. vittata (Ach.) Nyl.

2. Parmelia physodes (L.) Ach., Meth. Lich., 1803, p. 250; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 125; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 36; vol. 8, 1932, p. 563 et vol. 10, 1940, p. 529 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 57 — *Lichen physodes* L., Spec. Pl., vol. 2, 1753, p. 1144 — *Imbricaria physodes* (L.) D.C. in Lam. et De Cand., Fl. Franç., ed. 3, vol. 2, 1805, p. 393; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 18.

Macroscopical description. Thallus foliaceous, up to about 8 cm in diam., growing in rosettes or irregularly spreading, loosely adhering to the substratum, deeply incised. Lobes variously shaped, up to 1 or 2 cm long, 0.5—3 mm broad, contiguous, overlapping or widely separate, more or less richly and pinnately or irregularly branched, strongly folded, somewhat wavy or flat. Margins entire. Tips either lifted and inflated or not, usually broadened up to 5 or 6 mm, rounded, emarginate or incised. Upper side of the lobes grey or grey-green, with a tanned zone fringing the tip, here and there bordered with black by the projecting lower surface, dull or somewhat shiny, particularly at the tips, more or less convex, varying from smooth to faintly dented or strongly wrinkled, with occasional cortical cracks, usually sorediate and in some cases warty or isidiate. Soralia white, terminal, lip-shaped (soralia labriformia), having originated by the splitting of the thallus along the line where both cortices meet. Warts and isidia concolorous with the upper side of the thallus or with tanned apices, usually inflated. Lower side of the thallus black and dull, near the tips of the lobes dark or pale brown and shiny, reticulately dented or strongly wrinkled, with occasional openings at the tips. No rhizinae but with a few haustorial plates. *Microscopical description.* Upper cortex yellowish, paraplectenchymatous, 20—35 μ. Gonidia bright green, spherical, 8—14 μ, arranged in a continuous layer of 30—50 μ, closely under the upper cortex. Medulla colourless, white in reflected light, more or less densely plectenchymatous, detached from the lower cortex, 75—200 μ, consisting of mesodermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 1—2-layered, 12—15 μ. *Apothecia* rare, singly or few together, laminal, sessile or shortly pedicellate, at first cup-shaped, later saucer-shaped, 0.5—5 or even 8 mm in diam. Amphithecium concolorous with the thallus, dull, smooth or somewhat wrinkled. Margin narrow, entire, finally receding. Disc yellow-brown to red-brown, dull or somewhat shiny, epruinose. Epithecium yellow-brown, hymenium colourless, hypothecium colourless, with gonidia underneath. Hymenium 30—50 μ. Asci cylindrical to clavate, 9—15 × 25—36 μ, 8-spored. Spores colourless, ellipsoidal, thick-walled, 4—5 × 6—9 μ. Paraphyses simple or furcate, septate, conglutinate, not incrassate at the apex. *Pycnides* very common, laminal, usually confined to a certain area near the tips of the lobes, crowded, visible as black dots, spherical, 150—200 μ in diam. Perifulcrium dark, ostiolum black-brown. Pycnoconidia colourless, cylindrical, sometimes slightly constricted in the middle, straight or somewhat bent, ± 1 × 6—7 μ.

Chemical constituents and reactions. Upper cortex K + yellow, gradually turning red-brown, C —, KC + red-brown. Medulla (as well as the soralia) K + yellow, turning brown, C —, KC + orange-brown, Pd + instantaneously yellow, then turning orange. Zopf (Flechtenstoffe, 1907, p. 186, 226, 268, 419) reports the presence of the bitter physodalic acid ($C_{24}H_{20}O_{12}$), atranorin ($C_{19}H_{18}O_8$), and physodic acid ($C_{20}H_{22}O_6$). According to the investigations by Asahina and Nogami (Ber. Deutsch. Chem. Ges., vol. 67B, 1934, p. 805—811), the formula of the latter compound is incorrect and should be changed into $C_{26}H_{30}O_8$. They found the atranorin in *P. physodes* to contain chlorine (ibidem, vol. 68 B, 1935, p. 78).

Distribution. Common throughout Europe.

Remarks. It is hardly necessary to stress the extreme variability of *P. physodes*; it is much more important to emphasise the fact — so often ignored or overlooked by beginners — that most varieties and their forms are linked up by a continuous series of intermediate stages which may hamper a correct determination. When following Hillmann's subdivision, and setting aside the numerous extra-European varieties described by Müller Argov. (in Flora, vol. 66, 1883, p. 75—76, and vol. 69, 1886, p. 257), there are four main lines along which *Parmelia physodes* varies. In two of them the thallus is stout, often small and cushion-shaped, with folded lobes. These groups differ from each other in that one (var. *subcrustacea*) is, the other (var. *platyphylla*) is not papillate-isidiate. In the third group the thallus is well featured by conspicuous, usually broadly lip-shaped soralia (var. *labrosa*). The fourth group (var. *physodes*), finally, has only negative characters, the thallus is not folded, the lobes are not papillate-isidiate, they are esorediate or the soralia are inconspicuous. This group is less homogeneous than the others, consisting of widely diverse elements.

Fertile specimens are rare in Holland, yet they may generally be expected in glades or in any other moist place to which broad day-light has sufficient access. I was most lucky in finding them in sheltered, unkempt coppices of oak where the apothecia-bearing plants grow on the upper side of old branches nearest to the ground.

Sometimes the thallus rejuvenates through the development of narrow lobes which arise from the centre. These secondary folioles should not be mistaken for isidial outgrowths.

Specimens growing on twigs (e. g. of *Calluna*), with their lobes freely stretched into the air, tend to assume a graceful appearance with narrow and widely separate lobes, quite different from the usual, thick-set rosettes. Yet, they do not merit a separate name.

Occasionally, the upper side of the lobes is speckled with black, a feature also met with in other forms. Such mottled forms have been called var. *maculans* by Olivier (in Rev. de Bot., vol. 10, 1892, p. 618), and Hillmann (l. c. p. 63) made the combination var. *platyphylla* f. *maculans*.

In Bull. Soc. Roy. Bot. Belg., vol. 43, 1906, p. 252, Bouly de Lesdain described a var. *arenicola* which does not seem to differ from the type of *Parmelia physodes* else than by its habitat. If the soil-inhabiting specimens which are common in the dunes of the Netherlands agree with the type of Lesdain's *arenicola*, there is no appreciable difference indeed between that variety and var. *physodes* f. *eu-physodes*.

Key to the varieties and forms.

1a. Upper surface of the thallus smooth or somewhat wrinkled 2

2a. Thallus covered with papillae or isidia
var. **subcrustacea** (Flot. ex Körb.) Hillm. f. **papillosa** Erichs.

2b. Thallus without papillae or isidia 3

3a. Thallus esorediate or with soralia which are inconspicuous from above 4

4a. Thallus growing in rosettes or irregularly spreading 5

5a. Thallus growing on vertical substrata, upper half only present, lobes beautifully radiating
var. **physodes** (Weis) Maas G. f. **pinnata** (Anders) Hillm.

5b. Not as above 6

6a. Lobes rather narrow, about 1 mm broad, with numerous interstices in between them. Thallus esorediate, growing in lace-like rosettes
var. **physodes** (Weis) Maas G. f. **elegans** Mereschk.

6b. Lobes broader and closely contiguous, or thallus not growing in rosettes. Usually with a few sorediferous lobes
var. **physodes** (Weis) Maas G. f. **eu-physodes** Maas G.

4b. Thallus not growing in rosettes, lobes esorediate, widely separate, elongate, almost linear, partly bordered with black
var. **physodes** (Weis) Maas G. f. **vittatoides** Mereschk.

3b. Thallus with terminal lip-shaped soralia 7

7a. Some of the lobes with terminal, helmet-shaped swellings on the lower side of which there are soredia
var. **labrosa** Ach. f. **cassidiformis** Wereit.

7b. Terminal ends of the lobes without such swellings 8

8a. Lobes stout, soralia broad 9

9a. Upper lip of the soralia entire or, at most, somewhat torn
var. **labrosa** Ach. f. **eu-labrosa** Maas G.

9b. Upper lip repeatedly incised or lacerate, and more or less crispate . . var. **labrosa** Ach. f. **luxurians** (Harm.) Hillm.

8b. Lobes narrow and graceful, drooping, soralia narrow. Thallus on vertical substrata
var. **labrosa** Ach. f. **subtubulosa** (Anders) A. Zahlbr.

1b. Upper surface of the thallus either strongly folded or wrinkled, or isidiate . 10

10a. Thallus folded or wrinkled but not warty 11
  11a. Lobes with broad lip-shaped soralia
      var. **labrosa** Ach. f. **eu-labrosa** Maas G.
  11b. Thallus esorediate or nearly so, heavily folded. Marginal lobes broad and thick. Preferably on horizontal substrata var. **platyphylla** Ach.
10b. Thallus, at least in the centre, warty or isidiate, sometimes strongly wrinkled in addition 12
  12a. Thallus strongly folded and wrinkled, warty or isidiate
      var. **subcrustacea** (Flot. ex Körb.) Hillm. f. **granulosa** (Harm.) Maas G.
  12b. Thallus faintly wrinkled, even in the centre, scattered with papillae or isidia or small folioles
      var. **subcrustacea** (Flot. ex Körb.) Hillm. f. **papillosa** Erichs.

var. **physodes** (Weis) Maas G. nov. comb. — *Lichen laciniatus* var. *physodes* Weis, Pl. Cryptog. Fl. Gotting., 1770, p. 57.

Thallus growing in rosettes or wide-spreading. Lobes contiguous or widely separate, flat or somewhat wavy, with little conspicuous soralia or esorediate. Upper surface smooth, dented or slightly wrinkled.

Remarks. Under this variety some forms, including the form corresponding with the type of *physodes*, are united which have only few characters in common. They are widely divergent as to the shape of the thallus, and the position, ramification and dimensions of the lobes.

var. **physodes** f. **eu-physodes** Maas G. nov. f.

Typus: the same as of *Lichen physodes*.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 20, fig. 8; Bitter in Jahrb. wiss. Bot., vol. 36, 1901, tab. 7, fig. 1 (perhaps rather approaching var. *platyphylla*), 5—8; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 34; Gams in Karsten et Walter, Vegetationsbild., vol. 25, pars 1, 1936, tab. 2, fig. a; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, tab. 1, fig. 1; Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 5, fig. 1 (transition to var. *labrosa*); Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 21, fig. 4; Schulz-Korth in Rep. spec. nov. regn. veg. Beih., vol. 67, 1931, tab. 13, fig. 24, 25; tab. 23, fig. 45; Smith et Sowerb., Engl. Bot., vol. 2, 1793, tab. 126 (pr. p.); Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 2, fig. 1.

Thallus orbiculatus vel late expansus, lobis ± contiguis. Lobi nonnulli soralia obscura exhibentes.

Thallus growing in rosettes or wide-spreading, composed of more or less contiguous (including somewhat discrete and somewhat overlapping) lobes. Some of the lobes with inconspicuous soralia.

Ecology and frequency: On wood, deciduous and coniferous trees, on bare sand (in the dunes), over mosses, on tiles and concrete. Very common throughout the country, though frequently in a stage more or less approaching var. *labrosa* f. *eu-labrosa*.

Groningen: Haren, Harendermolen, *Aoker Stratingh* (Gro, NBV); *Van Hall* (NBV); Ter Apel, 24 XII 1906, 19 I 1907, 24 I 1907, *Tresling* (TA); 16 XII 1909, 15 I 1908, *Tresling*, transition to var. *labrosa* f. *eu-labrosa* (TA).

Drente: Angelsloo, 15 VII 1939, *Van Ooststroom & Zaneveld 7528* (L); Annen, 27 V 1855 (L); 3 V 1941, *Maas G. 780*, transition to var. *labrosa* f. *eu-labrosa* (L); Bronneger, 6 V 1941, *Maas G. 972b* (L); Diever, 10 V 1941, *Maas G. 1126* (L); Diever, Berkenheuvel, 22 VI 1941, *Meeuse* (L); Dwingelo, 31 VII 1941, *Maas G. 1412* (L); Emmen, Weerdinge, *Van Hall* (NBV); Emmen, Westenesch, 8 V 1941, *Maas G. 1091a* (L); Lheebroek, Lheebroekerzand, 31 VII 1941, *Maas G. 1440* (L); 31 VII 1941, *Maas G. 1433*, transition to f. *vittatoides* (L); Loon, 10 V 1941, *Maas G. 1124* (L);

Mantinge, Mantingerzand, 13 XII 1940, *Maas G. 277*, transition to f. *elegans* (L); Noordarge, 14 VII 1939, *Van Ooststroom & Zaneveld 7524, 7527* (L); Noordsleen, 9 V 1941, *Maas G. 1111* (L); Odoorn, 13 XII 1940, *Maas G. 346* (L); *Maas G. 356*, transition to var. *labrosa* f. *eu-labrosa* (L); Smilde, 1849, *Van den Bosch* (NBV); Valthe, 7 V 1941, *Maas G. 1068*, transition to var. *subcrustacea* f. *granulosa* (L).

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1141* (L); Lemele, Lemelerberg, 26 VII 1941, *Maas G. 1290* (L); 27 VII 1941, *Maas G. 1317* (L); *Maas G. 1317a*, transition to f. *elegans* (L); Lemele-Dalfsen, 27 VII 1941, *Maas G. 1318* (L); Lochuizen-Diepenheim, 20 VII 1941, *Maas G. 1179* (L); Mariënberg, 28 VII 1941, *Maas G. 1387* (L); Zwolle, Helmhorst, VII 1916, *Lako* (NBV).

Gelderland: Bennekom, 6 IX 1942, *Maas G. 2201* (L); 6 IX 1942, *Maas G. 2200*, transition to var. *labrosa* f. *eu-labrosa* (L); Bennekom, Oostereng-Quadenoord, 24 V 1943, *Maas G. 2483* (L); Doornspijk, 1941, *Groot & Van Soest 499, 500, 502, 503* (VS); Doornspijk, Nieuw Soerel, III 1942, *Groot & Van Soest 640* (VS); IV 1942, *Maas G. & Van Soest 774*, transition to var. *subcrustacea* f. *granulosa* (VS); Doornspijk, Soerel, IV 1942, *Maas G. & Van Soest*, c. ap. (VS); Doorwerth, *Buse & Buse-Koppiers* (NBV); Doorwerth, Duno, 9 II 1941, *Stafleu* (U); Garderen, I 1940, 5 I 1941, *Stafleu* (U); Ginkel, Planken Wambuis, *Buse* (NBV); Gorssel, 1845, 1846, *Top* (NBV); Harderwijk, *Bondam* (L); Hattem, VIII 1846, *Bondam* (L, NBV); Hierden, Hulshorst, 4 IV 1942, *Maas G. 1788* (L); Hierden, Hulshorst-Elspeet, 5 IV 1942, *Maas G. 1801* (L); Hierden, Hulshorst, Poolsche weg, 25 X 1941, *Maas G. 1594* (L); Hoenderloo, 16 X 1940, *Van der Linde* (L); 8 XI 1940, *Maas G. 125* (L); Hoenderloo, De Hooge Veluwe, 9 XI 1941, *Maas G. 172* (L); Kootwijk, 1 VIII 1942, Miss *Nolen* (L); Laag Soeren, 27 VIII 1941, *Van Ooststroom 7541*, transition to f. *elegans* (L); Leuvenum, Leuvenumsche bosch, 26 X 1941, *Maas G. 1667*, c. ap. (L); *Maas G. 1668*, transition to f. *elegans* (L); Nijmegen, *Abeleven* (L); Nijmegen-Groesbeek, 7 III 1941, *Maas G. 496* (L); Oldebroek, VIII 1939, *Groot & Van Soest 322* (VS); 23 X 1940, Miss *Caudri* (L); Overasselt, 7 IV 1942, *Stafleu* (U); Ubbergen, 11 IX 1851, *Abeleven* c. ap. (NBV); Velp, 11 IV 1919, *Florschütz* (U); Warnsveld, 28 XII 1929, *Wassink 3387* (Wask); 31 XII 1929, *Wassink 3380* (Wask); Wijchen, 19 VII 1873, *Van Hall* (L).

Utrecht: Amersfoort, *Bondam* (NBV); Baarn, 16 V 1887, *Wakker* (L); Baarn-Hilversum, 28 II 1943, *Maas G. 2280* (L); De Bilt, 1841, *Van der Sande Lacoste* (NBV); II 1841, *Van der Sande Lacoste* (L); De Bilt, Beerschoten, *Van den Bosch* (NBV); De Bilt, Oostbroek, 1 IV 1942, *Stafleu* (U); Bilthoven, 12 IV 1930, *Wassink 367* (Wask); *Wassink 365*, transition to var. *labrosa* f. *eu-labrosa* (Wask); Leersum, 26 X 1940, *Maas G. 53* (L); 27 X 1940, *Maas G. 90* (L); Maartensdijk, Beukenburg, 18 II 1941, *Stafleu* (U); De Vuursche, Lage Vuursche, Eyckestein, 22 II 1941, *Stafleu* (U); Zeist, II 1920, *Brakman* (L); Zeist, Den Dolder, 16 III 1927, *Wassink 3396* (Wask); 21 III 1929, *Wassink 3377* (Wask).

Noord-Holland: Bergen, 20 IX 1943, *Barkman 604*, transition to var. *labrosa* f. *eu-labrosa*, c. ap. (L); Bloemendaal, *Buse & Gildemeester-Buse* (NBV); Bloemendaal, Elswout, XII 1865 (NBV); Bloemendaal, Leiduin, X 1863, transition to var. *labrosa* f. *eu-labrosa* (NBV); Haarlem, VI 1839, *Molkenboer* (NBV); Overveen, VII 1840, *Buse & Gildemeester-Buse* (NBV); Texel, Westerduinen, IV 1940, *Stafleu* (U); Velzen, IV 1839, *Buse & Gildemeester-Buse* (NBV); Vlieland, Malgum, 12 VIII 1937, *De Vries* (Nga); Vlieland, Posthuis, 19 VIII 1937, *De Vries* (Nga); Vogelenzang, 19 I 1924, *Ten Kate* (L).

Zuid-Holland: Katwijk-Noordwijk, 17 V 1941, *Barkman* (L); Lisse, Keukenhof, 11 IV 1942, *Van Rossem 160*, transition to var. *labrosa* f. *eu-labrosa* (L); Wassenaar, 7 V 1819, *De Haan* (NBV); Wassenaar, Meiendel, 12 V 1941, *Maas G. 1024* (L); 5 VII 1941, *Stafleu*, transition to var. *labrosa* f. *luxurians* (U); 13 VII 1941, *Maas G. 1084a*, transition to var. *labrosa* f. *eu-labrosa* (L); 4 IV 1943, *Van Rossem 120*, transition to var. *labrosa* f. *eu-labrosa* (L); 10 V 1942, *Van Rossem 134* (L); Wassenaar, Raaphorst, XI 1944, *Van Soest 920* (VS); Wassenaar, Waalsdorp, 22 XI 1938, *Groot*, c. ap. (VS).

Zeeland: Walcheren, *Van den Bosch* (NBV); Walcheren, Oostkapelle, Oranjezon, VIII 1874, *Van Hennekeler* (Midbg).

Noord-Brabant: Bergeijk, 22 VII 1942, *Maas G. 2077*, transition to f. *vittatoides* (L); Borkel, XII 1923, *Smelt*, transition to var. *labrosa* f. *eu-labrosa* (VD Wijk); Oirschot, Spoordonk, 21 VIII 1941, *Wachter* (L); Waalre, X 1924, *Smelt* (VD Wijk).

Limburg: Eys, Eyserbosch, 6 VII 1942, *Van Rossem 193* (L); Maastricht, *Franquinet* (Maastr); Mook, Mookerheide, 9 III 1941, *Maas G. 583* (L); Mook, St. Jansberg, 8 IV 1942, *Stafleu* (U).

var. **physodes** f. **elegans** Mereschk. in Hedwigia, vol. 61, 1919, p. 197; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 42 et vol. 10, 1940, p. 529; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 62.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 20, fig. 9; Mereschk. in Hedwigia, vol. 61, 1919, tab. 2, fig. 3, 4.

Thallus growing in graceful, lace-like rosettes, esorediate. Lobes narrow, about 1 mm broad, with numerous interstices in between them and with conspicuously rounded axils.

Remarks. The name of Mereschkovsky is often abbreviated into Mer., but this may raise confusion, since P. B. Merino previously used the same abbreviation (Broteria, vol. 11, 1913).

I feel some difficulty in the conception of this form. As a matter of fact, the description by Mereschkovsky is somewhat slight, whereas, according to the photographs in Hedwigia, the original specimens do not seem to differ so much from f. *eu-physodes* as to deserve a separate name. If, on the other hand, we look at the fine photograph in Anders, the distinction is much clearer, and it is worth noting that the latter also adds his own name after f. *elegans*. I wonder if under the present circumstances we had not better drop at all f. *elegans* Mereschk., this being synonymous with *Parmelia physodes*, and rename Anders' form.

Gelderland: Hierden, Hulshorst, 23 VII 1934, *Kruyt* (L).
Utrecht: De Vuursche, Lage Vuursche, Eyckestein, 22 II 1941, *Stafleu* (U).

var. **physodes** f. **pinnata** (Anders) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 62; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 530 — *Parmelia physodes* f. *platyphylla* m. *pinnata* Anders, Strauch- u. Laubfl. Mitteleurop., 1928, p. 137 — *Parmelia physodes* var. *platyphylla* f. *pinnata* Anders; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 46.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 21, fig. 1.

Thallus growing in dimidiate rosettes, i. e. such of which the lower halves are missing. Upper halves stellate, closely appressed, deeply incised, esorediate or nearly so. Lobes beautifully radiating, elongate, almost regularly pinnatifid.

Ecology and frequency. On vertical substrata and preferably on smooth bark, mainly in woods, rare.

Gelderland: Ellekom, VII 1891, *Top*, not typical (L); Elspeet, Elspeeterbosch, 27 X 1941, *Maas G. 1718* (L).

var. **physodes** f. **vittatoides** Mereschk., Nachtr. Flechtenliste Umgeb. Reval, 1913, p. 61 (non vidi); A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 44; vol. 8, 1932, p. 563 et vol. 10, 1940, p. 530; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 62.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 20, fig. 10; Mereschk. in Hedwigia, vol. 61, 1919, tab. 2, fig. 2.

Thallus not growing in rosettes. Lobes widely separate, elongate, narrow, 1 mm broad or less, almost linear, partly bordered with black, sub-dichotomously branched, esorediate.

Ecology and frequency. A form mainly occurring on twigs of *Calluna*, apparently rare.

Gelderland: Bennekom, 1849, *Buse & Buse-Koppiers* (NBV); Harderwijk, *Bondam* (L); Hierden, Hulshorst-Elspeet, 5 V 1942, *Maas G. 1801* (L).
Limburg: Maastricht, *Franquinet* (Maastr).

var. **platyphylla** Ach., Meth. Lich., 1803, p. 251; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 46 et vol. 10, 1940, p. 530 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 63.

Thallus growing in stout rosettes, heavily folded, more or less wrinkled. Marginal lobes more flattened, very short, thick, contiguous, esorediate or nearly so.

Ecology and frequency. Mainly on horizontal substrata, rare.

Remarks. In Hillmann's description of var. *platyphylla* nothing is said about the lobes being folded or the upper surface being wrinkled. Yet, these features were clearly emphasised by Acharius (l. c.): "In hac centrum thalli rugosum plicatum verrucosum..." The photograph, quoted by Hillmann, in Anders' Strauch- u. Laubfl. Mitteleurop., 1928 (tab. 20, fig. 8) does not conform with the original Acharian description; in my opinion it represents var. *physodes* f. *eu-physodes*.

Gelderland: Hoenderloo, De Hooge Veluwe, 9 XI 1940, *Maas G. 172*, not typical (L).
Utrecht: Tienhoven, 6 VII 1942, *Maas G. 1987* (L).
Noord-Holland: Bloemendaal, *Buse* (NBV); Overveen, *Buse* (U).

var. **labrosa** Ach., Lichenogr. Univ., 1810, p. 493; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 44 et vol. 10, 1940, p. 530 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 64

Thallus growing in rosettes or irregularly wide-spreading. Lobes contiguous or widely separate, flat or wavy. Upper surface smooth, dented or wrinkled. Some or most lobes soraliferous, with conspicuous lip-shaped soralia.

Remarks. The forms of this variety show greater uniformity than those of var. *physodes* in that they are all characterised by the conspicuous lip-shaped soralia.

var. **labrosa** f. **eu-labrosa** Maas G. nov. f.

Typus: the same as of var. *labrosa*.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 20, fig. 7; Bitter in Jahrb. wiss. Bot., vol. 36, 1901, tab. 7, fig. 2, 3; Wulf. in Jacquin, Collect. Bot., vol. 3, 1789, tab. 8, fig. media; this paper fig. 13 B.

Soralia lata, adscendentia.

Soralia broad, curved upwards.

Ecology and frequency: On all kinds of substrata, and attached to them with the greater part of the thallus. If on thin twigs, with narrower and more graceful lobes which grow widely separate, stretching freely into the air. This is the commonest form of *Parmelia physodes* showing every conceivable transition to the other varieties, more particularly to the forms *eu-physodes* and *vittatoides*.

Groningen: Groningen, 10 III 1866, *Holkema* (NBV); Haren, *Acker Stratingh* (Gro); IV 1841, *Van Hall* (NBV); Haren, Dilgt, *Acker Stratingh* (Gro); Haren, Harendermolen, IV 1836, *Van Hall* (NBV); Noordlaren, II 1856, *Acker Stratingh* (Gro); Ter Apel, II 1906, 28 XII 1906, II 1908, *Tresling* (TA); Zuidbroek, Oosteinde, I 1846 (Gro).

Drente: Diever, Berkenheuvel, 22 VI 1941, *Meeuse*, transition to var. *physodes* f. *vittatoides* (L); Eelde, Oosterbroek, 14 VIII 1855, *Van Hall* (NBV); Eext, 3 V 1941, *Maas G. 753* (L); Emmen, 15 VII 1939, *Van Ooststroom & Zaneveld 7525* (L); 8 V 1941, *Maas G. 1088* (L); Mantinge, Mantingerbosch, 13 XII 1940, *Maas G. 268* (L); 9 V 1941, *Maas G. 1118* (L); Midlaren, 25 XI 1905, *Tresling* (TA); Schipborg, 5 V 1941, *Maas G. 893* (L); Spier, 28 VIII 1932, *Lütjeharms 45* (L); Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld 7526* (L).

Overijsel: Dalfsen, Aalhorst, XI 1912, *Lako* (NBV); Diepenheim, 19 VII 1941, *Maas G. 1143* (L); 21 VII 1941, *Maas G. 1198* (L); Diepenveen, V 1847, *Bondam* (NBV); Heino, XI 1908, *Lako* (NBV); Kampen, 25 VIII 1891, *Top* (NBV); Raalte, I 1909, *Lako* (L, NBV); Vasse, 7 VI 1933, *Nannenga 1* (NGA); Wijhe, II 1909, *Lako* (L, NBV); Zeesse, 28 VII 1941, *Maas G. 1368* (L); Zwolle, III 1909, *Lako* (L, NBV); IV 1909, *Lako* (NBV).

Gelderland: Apeldoorn, *Stolz* (L); Apeldoorn, 't Loo, *Van der Sande Lacoste* (L); Bennekom, 6 IX 1942, *Maas G. 2200*, c. ap. (L); Doetinchem, 24 VIII 1939, *Groot & Van Soest* (VS); Doornspijk, 1941, *Groot & Van Soest 501* (VS); Doornspijk, Soerel, IV 1942, *Maas G. & Van Soest 775*, transition to var. *subcrustacea* f. *papillosa* (VS); Doorwerth, *Buse & Buse-Koppiers* (NBV); Ede, 30 IV 1939, *Groot & Van Soest 324* (VS); Ellekom, Hagenau, 13 VI 1943, *Maas G. 2535* (L); 8 VIII 1942, *Van Rossem 263* (L); Harderwijk, *Bondam* (L); Hatert, III 1847, *Abeleven* (NBV); Hattem, Trijsberg, *Top* (NBV); IX 1889, *Top* (L); Hierden, Hulshorster zand, 4 IV 1942, *Maas G. 1793* (L); Hoenderloo, 16 X 1940, *Van der Linde* (L); 8 XI 1940, *Maas G. 148, 155* (L); Hoenderloo, De Hooge Veluwe, 9 XI 1940, *Maas G. 170* (L); Hoenderloo, Westervlier, 9 XI 1940, *Maas G. 181* (L); Hoenderloo-Uchelen, 26 III 1943, *Maas G. 2338*, c. ap. (L); Laag Soeren, 27 VIII 1941, *Van Ooststroom 7543* (L); Nunspeet, VII 1891, *Top* (NBV); Nijkerk, 24 II 1866, *Bondam* (L); Nijkerk, Hoef, *Stolz* (L); Nijmegen, *De Beyer* (NBV); 24 VIII 1873, *Abeleven* (L); IV 1922, *Ten Kate* (L); 9 II 1940, *Stafleu* (U); Nijmegen, Berg en Dal, 26 VIII 1865, *Van Hall* (NBV); Nijmegen, Meerwijk, VIII 1890, *Top* (L); Oldebroek, IX 1895, *Top* (NBV); VIII 1939, *Groot & Van Soest 115, 326* (VS); 23 X 1940, *Maas G. 375* (L); Speulde, 28 V 1939, *Nannenga 827* (Nga); Renkum, *Buse & Buse-Koppiers* (NBV); Ubbergen, II 1850, *Abeleven* (L); III 1850, *Abeleven* (L, NBV); Voorst, 27 XII 1919, *Hart de Ruyter* (U); Warnsveld, 26 XII 1929, *Wassink 3368, 3386* (Wask); Winterswijk, Bekkendelle, 14 X 1939, *Nannenga 1004* (Nga).

Utrecht: Baarn, 25 II 1900, *Resink & Pulle* (U); Baarn, Overbosch, 16 V 1887, *Wakker* (L); Baarn, Soestdijk, *Van der Sande Lacoste*, c. ap. (L); VII 1849, *Van der Sande Lacoste* (NBV); 28 VII 1850, *Van der Sande Lacoste*, c. ap. (L, NBV); De Bilt, 1840, 1841, *Van der Sande Lacoste* (L); 16 I 1930, *Wassink 3357* (Wask); 8 III 1930, *Wassink 236* (Wask); De Bilt, Beerschoten, III 1841, *Van der Sande Lacoste* (NBV); 14 I 1930, *Wassink 210*, c. ap. (Wask); Bilthoven, 12 IV 1930, *Wassink 366* (Wask); Doorn, 20 IV 1941, *Maas G. 710b* (L); Driebergen, *Van Hall* (L); 3 IX 1834, *Van Hall* (NBV); Huis ter Heide, 1 VIII 1859, *Van Hall*, c. ap. (NBV); 15 VIII 1859, *Van Hall* (L); 28 VII 1861, *Van Hall* (NBV); Leersum, 26 X 1940, *Maas G. 44, 47* (L); Leersum, Darthuizen, 14 VIII 1838, 23 VIII 1843, *Van Hall* (NBV); Maartensdijk, Beukenburg, 2 II 1940, *Stafleu* (U); Zeist, 7 I 1930, *Van Ooststroom 2794* (L).

Noord-Holland: Callantsoog, Zwanenwater, 23 V 1941, *Schroevers* (L); Haarlem, *Buse & Buse-Koppiers* (L); Santpoort, *Buse* (L); Terschelling, Koegelwieck, 24 VIII 1938, *Nannenga 1086* (Nga); Texel, Binnen Muy, 13 V 1942, *Stafleu* (U); Texel, Westerduinen, IV 1940, *Stafleu* (U); Texel, Westermient, 9 V 1942, *Stafleu* (U); Velzen, *Buse & Gildemeester-Buse* (L); Vogelenzang, *Buse* (L); 19 I 1924, *Ten Kate* (L).

Zuid-Holland: 's Gravenhage, 21 X 1922, *Ten Kate* (L); 27 IV 1930, *Van Ooststroom 3119* (L); Leiden, Oud Poelgeest, 2 V 1941, *Barkman* (L); Noordwijkerhout, 19 XII 1912, *Ten Kate* (L); Wassenaar, Duinrel, 14 V 1942, Miss *Koster 668* (L); 13 XI 1938, *Groot & Van Soest 20a* (VS); 5 VII 1941, *Stafleu* (U); 10 V 1942, *Van Rossem 143* (L); Wassenaar, Waalsdorp, XI 1938, *Groot 317* (VS).

Zeeland: Walcheren, IX 1841, *Van den Bosch* (NBV).
Noord-Brabant: Breda, Mastbosch, 1852, unio NBV (NBV).

var. **labrosa** f. **cassidiformis** Wereit. in Bull. Jard. Imp. Bot. St. Pétersbourg, vol. 7, 1906, p. 132 (non vidi).

Some of the lobes inflated at their tips, and forming a helmet-shaped swelling, the lower side of which is sorediate.

Remarks. These swellings very much resemble those of *Physcia adscendens.*

Gyelnik (in Rep. spec. nov. regn. veg., vol. 36, 1934, p. 302) describes f. *fornicata* as a new form which, according to the description, exactly agrees with that of *cassidiformis.* Gyelnik's name is, apart from being synonymous, invalidated by Wallroth's homonym (Fl. Cryptog. German., vol. 3, 1831, p. 490). On the other hand, it is by no means clear what actually is meant by Wallroth's *P. ceratophylla* var. *phyllodes* m. *fornicatum,* on which account I prefer to stick to *cassidiformis,* the description of which has been cited by Mereschkovsky in Hedwigia, vol. 61, 1919, p. 198.

Gelderland: Hoenderloo, 26 III 1943, *Maas G. 2331,* partly (L); Leuvenum, Leuvenumsche bosch, 25 X 1941, *Maas G. 1600,* partly (L); Nijmegen, 11 IX 1851, *Abeleven* (NBV).
Noord-Holland: Haarlem, Woestduin, *Buse & Gildemeester-Buse* (NBV).

var. **labrosa** f. **luxurians** (Harm.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 64; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 530 — *Parmelia physodes* var. *vulgaris* f. *platyphylla* s. f. *luxurians* Harm. in Bull. Soc. Sci. Nancy, ser. 2, vol. 31 (1896) 1897, p. 234.

Iconography: this paper fig. 13 A.

Lip-shaped soralia incised and lacerate, having a crispate appearance.

Utrecht: De Vuursche, Lage Vuursche, Eyckestein, 5 IV 1942, *Vervoort* (L).
Noord-Holland: Texel, Westermient, 9 V 1942, *Stafleu* (U).

var. **labrosa** f. **subtubulosa** (Anders) A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 45 et vol. 10, 1940, p. 530; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 64 — *Parmelia physodes* f. *labrosa* m. *subtubulosa* Anders, Strauch- u. Laubfl. Mitteleurop., 1928, p. 137.

Thallus irregularly wide-spreading. Lobes, at least several of them, pointing downwards and parallel, conspicuously tubular, particularly at the tips, narrow, rather short, with small lip-shaped soralia.

Ecology. On vertical substrata, mainly on *Pinus.*

Remarks. It is the drooping tubular lobes that give this form its peculiar *tubulosa*-like appearance.

Overijsel: Holten, 21 VII 1941, *Maas G. 1230* (L).
Gelderland: Ellekom, Hagenau, 13 VI 1943, *Maas G. 2549* (L); Hierden, Hulshorst, 23 VII 1934, *Kruyt* (L); Warnsveld-Lochem, 19 VII 1941, *Maas G. 1137* (L).

var. **subcrustacea** (Flot. ex Körb.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 65; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 530 (ubi lit. et synon.) — *Imbricaria physodes* f. *subcrustacea* Flot. ex Körb., Lichenogr. German. Specim., 1846, p. 11 (non vidi) — *Parmelia physodes* f. *subcrustacea*; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 44.

Thallus growing in rosettes or irregularly wide-spreading, more or less cushion-shaped, thick. Lobes contiguous or overlapping, wavy or

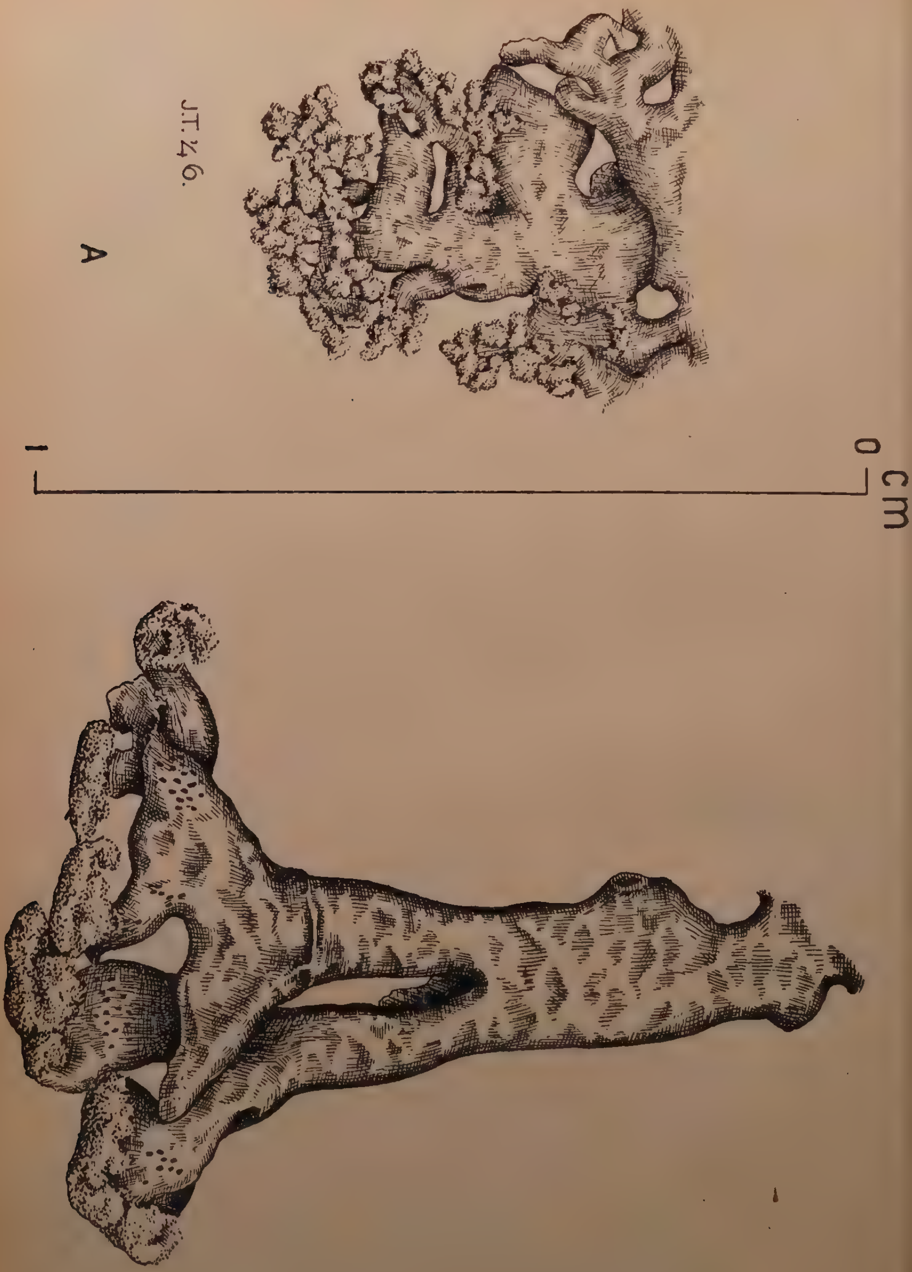


Fig. 13 — *Parmelia physodes* (L.) Ach. var. *labrosa* Ach.

A. Sorediferous lobe of f. *luxurians* (Harm.) Hillm.
B. Sorediferous lobe of f. *eu-labrosa* Maas G.

strongly folded, papillate-isidiate or sometimes wrinkled as well, esorediate or with soralia which are never broadly lip-shaped.

Remarks. The occurrence of isidia is a feature by which the forms of this variety are well marked off from those of the other varieties. Yet, transitional phases may be observed between forms of var. *subcrustacea* and var. *physodes* when in the latter the thalli grow more wrinkled with age, tending to become warty.

var. **subcrustacea** f. **granulosa** (Harm.) Maas G. nov. comb. — *Parmelia physodes* var. *vulgaris* f. *platyphylla* s. f. *granulosa* Harm. in Bull. Soc. Sci. Nancy, ser. 2, vol. 31, (1896) 1897, p. 234.

Iconography: Bitter in Jahrb. wiss. Bot., vol. 36, 1901, tab. 9, fig. 27—29.

Lobes strongly folded and wrinkled, towards the centre of the thallus the wrinkles gradually turn into more or less crowded warts or inflated, clavate isidia which may finally burst at their apices, and become sorediose.

Ecology and frequency: In places exposed to the wind, common in Holland.

Remarks. I consider f. *granulosa* to be conformable with the type of var. *subcrustacea*. There are intergradations between this form and f. *eu-physodes* as well as f. *eu-labrosa*. In some cases the lip-shaped soralia show an exuberant growth, not unlike those of var. *labrosa* f. *luxurians*, and such specimens may indeed be regarded as transitional stages.

In my opinion var. *subcrustacea* f. *granulosa* is a growth form induced by the desiccating action of continuous winds, in contrast to the views held by Bitter. This author (in Jahrb. wiss. Bot., vol. 36, 1901, p. 461, 463) argues that the habit of strongly plicate and isidiate forms of *Parmelia physodes* is largely due to a raised atmospherical humidity of the habitat: "Besonders stärkere Feuchtigkeit scheint die Isidienbildung auf der Lappenoberfläche... zu begünstigen..." (p. 461); "Dazu bedarf es wohl einer besonders wasserreichen Atmosphäre..." (p. 463). Apparently, Bitter overlooked the fact that the desiccation is enormous in places where strong winds prevail ("die ungebrochene Kraft der Luftströmungen")! [p. 463].

As far as my experience goes, a more sheltered habitat gives rise to var. *subcrustacea* f. *papillosa*, though I must admit that our knowledge of the conditions is incomplete.

Friesland: Sexbierum, 25 VIII 1942, *Maas G. 2175* (L).

Drente: Anlo, 3 V 1941, *Maas G. 763* (L); Anlo-Zuidlaren, 3 V 1941, *Maas G. 758* (L); Bronneger, 6 V 1941, *Maas G. 968, 972c, 978, 989* (L); Diever, 10 V 1941, *Maas G. 1130a* (L); Drouwen-Borger, 7 V 1941, *Maas G. 1011* (L); Ees, 7 V 1941, *Maas G. 1017* (L); Eext, 5 V 1941, *Maas G. 895* (L); Loon, 18 VII 1939, *Van Ooststroom & Zaneveld 7523* (L); Norg-Een, 4 V 1941, *Maas G. 881* (L); Valthe, 7 V 1941, *Maas G. 1062* (L); Westerveld, 4 V 1941, *Maas G. 874* (L).

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1142* (L); 21 VII 1941, *Maas G. 1209* (L); Hellendoorn, 26 VII 1941, *Maas G. 1288* (L); Holten, 25 VII 1941, *Maas G. 1277a* (L); *Maas G. 1277 c*, transition to f. *papillosa* (L); Lemele, 28 VII 1941, *Maas G. 1359* (L;) Markelo-Laren, 23 VII 1941, *Maas G. 1263* (L); Zwolle, XI 1908, *Lako* (NBV); I 1909, VII 1916, *Lako* (L); Zwolle, Mariënheuvel XI 1908, *Lako* (L).

Gelderland: Doornspijk, IV 1942; *Maas G. & Van Soest 807*, transition to f. *papillosa* (VS); 25 IV 1942, *Maas G. 1825* (L); Doornspijk, De Haere, 26 IV 1942, *Maas G. 1869* (L, VS); Doornspijk, Soerel, 25 IV 1942, *Maas G. 1850, 1867* (L); Hierden, Hulshorst, 4 IV 1942, *Maas G. 1789a*, transition to f. *papillosa* (L); Hoenderloo-

Beekbergen, Spelderholt, 28 III 1943, *Maas G. 2389*, partly transition to var. *labrosa* f. *luxurians* (L); Hoenderloo-Uchelen, 26 III 1943, *Maas G. 2339*, transition to f. *papillosa* (L); Nijmegen, Berg en Dal, 17 I 1873, *Van Hall* (L); VI 1939, *Groot & Van Soest 611* (VS); Staverden, 27 X 1941, *Maas G. 1740* (L); Warnsveld, 26 XII 1929, *Wassink 3376* (Wask).

Utrecht: Amersfoort, 3 IV 1942, *Maas G. 1783* (L); Bunnik, Rijnauwen, 21 III 1941, *Nannenga 1141* (Nga); Doorn, 19 IV 1941, *Maas G. 686*, transition to f. *papillosa* (L); 20 IV 1941, *Maas G. 710a*, transition to f. *papillosa* (L); Huis ter Heide, 15 VIII 1859, *Van Hall* (L); Leersum, 26 X 1940, *Maas G. 253* (L); Maarn, 15 III 1930, *Wassink 316* (Wask); Odijk, 26 I 1941, *Stafleu* (U); Utrecht, Oostbroeklaan, 17 V 1930, *Van Ooststroom & Wassink 423* (Wask); Veldhuizen-De Meern, 4 IV 1942, *Stafleu* (U).

Noord-Holland: Oostwoud-Hauwert 8 IV 1945, *Maas G. 3162* (L); Overveen, *Buse & Gildemeester-Buse* (NBV); Texel, Fonteinsnol, 12 V 1942, *Stafleu* (U); Texel, Westermient, 10 V 1942, *Stafleu* (U).

Zuid-Holland: Ruigenhoek, 6 VII 1941, *Maas G. 1050* (L); Wassenaar, Meiendel, 10 V 1942, *Van Rossem 137* (L); 13 IX 1942, *Maas G. 2224* (L).

Zeeland: Walcheren, Nieuw en St. Joosland, 25 III 1941, *Brakman* (L); Zuid Beveland, 's Heer Arendskerke, 3 V 1941, *Brakman* (L); Zuid Beveland, 's Heerenhoek, 2 V 1941, *Brakman* (L).

Noord-Brabant: Aalst, Achtereind, 24 VII 1942, *Maas G. 2099* (L); Bergeyk, 22 VII 1942, *Maas G. 2063* (L); Nuenen, V 1924, *Smelt* (VD Wijk); Riethoven, 25 VII 1942, *Maas G. 2100* (L).

Limburg: Epen, 16 VI 1941, *Stafleu* (U); Holset, 13 VII 1942, *Maas G. 2026* (L).

var. **subcrustacea** f. **papillosa** Erichs. in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 9; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 563 et vol. 10, 1940, p. 530; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 66.

Lobes wavy or folded, but upper surface only slightly wrinkled or almost smooth, with scattered papillae or inflated isidia which may have a tanned apex. Sometimes the isidia burst with age, and become sorediose.

Remarks. According to Erichsen, this form owes its appearance to incessant winds, and, as a matter of fact, the cushion-like shape and the smallness of the thallus are in favour of this view. However, I once found some specimens, undoubtedly f. *papillosa*, in a well-sheltered and rather moist place, with fairly normal thallus. Other finds have also been made in more or less sheltered places.

It may be remarked that, occasionally, the isidia grow out into small, somewhat inflated folioles.

Drente: Diever, 10 V 1941, *Maas G. 1130b* (L); Hoogeveen, 12 XII 1940, *Maas G. 256* (L); Norg-Een, 4 V 1941, *Maas G. 881a* (L).

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1142b* (L); Holten, 25 VII 1941, *Maas G. 1277b* (L).

Gelderland: Hierden, Hulshorst, 4 IV 1942, *Maas G. 1789* (L); Nijmegen, 9 II 1940, *Stafleu* (U).

Utrecht: Bilthoven, 15 II 1941, *Nannenga 1101* (Nga); De Vuursche, Lage Vuursche, Eyckestein, 22 II 1941, *Stafleu* (U).

Zuid-Holland: Wassenaar, Meiendel, 13 XI 1938, *Groot & Van Soest 320b* (VS).

Limburg: Mook, Plasmolen, Zevendal, 9 III 1941, *Maas G. 571* (L).

3. **Parmelia vittata** (Ach.) Nyl. in Flora, vol. 58, 1875, p. 106; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 49; vol. 8, 1932, p. 569 et vol. 10, 1940, p. 540 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 68 — *Parmelia physodes* var. *vittata* Ach., Meth. Lich., 1803, p. 251; Van den Bosch in Prodr. Fl. Batav.,

vol. 2, pars 2, 1853, p. 126 — *Imbricaria physodes* var. *vittata* Körb., Lichenogr. German. Specim., 1846, p. 11 (non vidi); Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 18.

Macroscopical description. Thallus foliaceous, not growing in rosettes, irregularly wide-spreading, loosely adhering to the substratum, deeply incised. Lobes slender, elongate, up to 3 or 4 cm long, 0.5—2 mm broad, widely separate, discrete, imbricate or entangled, dichotomously or irregularly branched, either with or without small side-branches at right angles, flat or somewhat wavy. Margins entire. Tips of the non-soraliferous lobes little or not broadened, almost acute, more rarely furcate, flat. Upper side of the lobes grey, grey-green or brownish grey, tanned at the tip or not, frequently bordered by a broad black zone of the bulging lower surface, shiny, flat or sometimes partly and only slightly convex, smooth or, particularly in older specimens, somewhat uneven, with occasional cortical cracks. Part of the lobes sorediate. Soralia white, terminal, lip-shaped (soralia labriformia), simple or giving the impression of being furcate by the coalescence of two adjacent soralia, more or less curved upwards. Lower side of the lobes black, turning dark to pale brown at the tips, shiny, inflated, reticulately dented to strongly wrinkled, without rhizinae, with large round openings at the tips and at the axils. *Microscopical description.* Upper cortex colourless or yellowish, paraplectenchymatous, 12—30 μ. Gonidia bright green, spherical, 8—14 μ, arranged in a layer of about 30 μ. Medulla colourless, white in reflected light, but soon turning brownish around the medullary cavity, rather densely plectenchymatous, 90—120 μ, consisting of mesodermatous hyphae, splitting close to the lower cortex, and leaving a large cavity. Lower cortex black-brown, paraplectenchymatous, 1—2-layered, 9—15 μ. *Apothecia* and *pycnidia* not observed.

Chemical constituents and reactions. Upper cortex K + yellowish, finally turning red-brown, C —, KC + yellow, then red-brown, Pd —. Medulla (as well as the soralia) K —, C —, KC —, Pd — or + slowly yellowish green.

Distribution. As stated by Hillmann (l. c. p. 70), *Parmelia vittata* is a mountainous species which is occasionally also found in lower regions. This author doubts the reliability of the records in older literature, so that little can be said concerning the distribution of *vittata* in Europe, more particularly in the Mediterranean countries. It may be noted that the species is not recorded from Portugal by Tavares (in Portugal. Act. Biol., vol. 1B, 1945).

var. **vittata** (Ach.) Maas G. nov. comb. — *Parmelia physodes* var. *vittata* Ach., Meth. Lich., 1803, p. 251.

Thallus not forming a coherent turf. Lobes discrete or widely separate, up to 3 or 4 cm long.

var. **vittata** f. **eu-vittata** Maas G. nov. f.

Typus: the same as of *P. physodes* var. *vittata*.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 21, fig. 2; Bitter in Hedwigia, vol. 40, 1901, tab. 15, 16, et in Jahrb. wiss. Bot., vol. 36, 1901, tab. 10, fig. 37, tab. 13, fig. 59; Harm., Lich. France, vol. 4, 1909, tab. 14, fig. 4; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, fig. 3.

Thallus supra cinereus.

Upper side of the lobes grey in various shades.

Ecology and frequency. On twigs of *Calluna*, over mosses. No recent finds have been made, and it must be feared that this handsome species has gone lost for the native flora.

Remarks. The paraphenylenediamin-reaction is a decisive distinguishing mark between *P. vittata* and some forms of *P. physodes* for home use, but also in the field *vittata* may be recognised by its long, slender lobes bordered with black, by the flat, smooth and more shiny upper surface, and by the openings in the strongly inflated lower side.

Groningen: Haren, Harendermolen, III 1827, *Van Hall* (NBV).
Gelderland: Harderwijk, *Bondam* (NBV).

Series 2. *Capitato-soraliferae* (Bitt.) Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 72; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 503 — *Capitate-soraliferae* Bitt. in Hedwigia, vol. 40, 1901, p. 173, 179.

Soralia terminal, head-shaped, having come into being by the disintegration of the upper cortex; there is no communication between the medullary cavity and the open air.

4. **Parmelia tubulosa** (Schaer.) Bitt. in Hedwigia, vol. 40, 1901, p. 179, 206 et in Jahrb. wiss. Bot., vol. 36, 1901, p. 429; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 48; vol. 8, 1932, p. 569 et vol. 10, 1940, p. 539 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 72 — *Parmelia ceratophylla* var. *tubulosa* Schaer., Lich. Helvet. Spicil., sect. 10, 1840, p. 459.

Macroscopical description. Thallus foliaceous, up to 6 or 8 cm in diam., rarely growing in regular rosettes, mostly wide-spreading, loosely adhering to the substratum, deeply incised. Lobes almost terete, 1—2 cm long, 1—2 mm broad in the centre of the thallus usually ascending, entangled, widely separate, at the circumference more appressed, stellate, contiguous or overlapping, dichotomously or irregularly branched, though as a rule, with few side branches. Margins entire. Tips somewhat raised, broadened or not, rounded, emarginate or furcate. Upper side of the lobes light to dark grey, tanned at the tips of the lobes, usually growing darker towards the centre of the thallus, dull or somewhat shiny at the tips, convex, varying from smooth to wrinkled, or isidiate and becomingserediose, with a few cortical cracks. Some of the lobes (on vertical substrata those pointing downwards) serediate. Soralia terminal, head-shaped (soralia capitiformia), greyish or white by abrasion, usually somewhat broader than the soraliferous lobe, and enclosing the whole of the apex, not infrequently indented though never perforated. Lower side of the lobes black and dull or shiny in the centre, dark to pale brown and shiny at the tips, inflated, reticulately or irregularly wrinkled, without rhizinae, with occasional haustorial discs. *Microscopical description.* Upper cortex colourless, paraplectenchymatous, 15—21 μ. Gonidia bright green, spherical, 9—14 μ, arranged in a layer of 30—50 μ. Medulla colourless, white in reflected light, or somewhat brownish, somewhat densely plectenchymatous, up to

140 μ, consisting of mesodermatous hyphae, soon detached from the lower cortex, and leaving a cavity. Lower cortex black-brown, paraplectenchymatous, 1—2-layered, 9—12 μ. *Apothecia* not observed in Holland, *pycnidia* unknown.

Chemical constituents and reactions. Upper cortex K + yellowish, slowly turning red-brown, C —, KC + yellowish, then red-brown, Pd —. Medulla (as well as the soralia) K + yellow, slowly turning red-brown, C — or + faintly yellow-brown, KC + red-brown, Pd — or + slowly yellowish green.

Distribution. Occurring throughout Europe.

Remarks. In older thalli the sorediose disintegration of the upper cortex may proceed further backwards so that, in accordance with the originally furcate or tripartite tips of the lobes, the soralia get a di- or trichotomous appearance.

An interesting specimen was sent to me by Mr Brakman, collected near Oostkapelle (Island of Walcheren), which is quite homologous to *Parmelia physodes* var. *subcrustacea* f. *papillosa* in bearing inflated papillae and isidia.

Parmelia tubulosa is always well marked off from *physodes* by its head-shaped soralia, by the closed tips of the soraliferous lobes, and by its different reaction upon Pd.

Key to the forms.

1a. Upper surface of the lobes smooth or somewhat wrinkled
f. **tubulosa** (Schaer.) Maas G.
1b. Upper surface of the lobes wrinkled or warty-isidiate, sorediose
f. **farinosa** Hillm.

f. **tubulosa** (Schaer.) Maas G. nov. comb. — *Parmelia ceratophylla* var. *tubulosa* Schaer., Lich. Helvet. Spicil., sect. 10, 1840, p. 459.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 21, fig. 3; Bitter in Hedwigia, vol. 40, 1901, fig. 3A et in Jahrb. wiss. Bot., vol. 36, 1901, tab. 7, fig. 9, 10; tab. 8, fig. 11—24; Harm., Lich. France, vol. 4, 1909, tab. 14, fig. 3; Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 5, fig. 4; Migula, Kryptog.-Fl. Deutschl., vol. 1, 1929, tab. 20, fig. 5; Schulz-Korth in Rep. spec. nov. regn. veg. Beih., vol. 67, 1931, tab. 18, fig. 34; Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 2, fig. 2; Wulf. in Jacquin, Collect. Bot., vol. 3, 1789, tab. 8, fig. infima (shape exaggerated).

Upper surface of the lobes smooth or faintly dented, turning more wrinkled towards the centre of the thallus.

Ecology and frequency: On coniferous and deciduous trees, in heaths on *Calluna*, on wood, sometimes on boulders, and over mosses. In more or less sheltered places, obviously more hygrophilous than *Parmelia physodes* in whose company it is nearly always found, and much less common than that species.

Remarks. I consider this form identical with the type of *Parmelia ceratophylla* var. *tubulosa*.

Groningen: Groningen, *Acker Stratingh* (Gro); Ter Apel, II 1908, *Tresling* (TA); Zuidbroek, Oosteinde, I 1846 (Gro).

Drente: Dwingelo, 31 VII 1941, *Maas G. 1411,* transition to f. *farinosa* (L); 1 VIII 1941, *Maas G. 1454* (L); Noordbarge, 8 V 1941, *Maas G. 1097* (L); Norg, VIII 1889, *Top* (L).

Overijsel: Denekamp, Singraven, 8 VIII 1879, *Van der Sande Lacoste* (Gro); Diepenheim, 19 VII 1941, *Maas G. 1139* (L); 21 VII 1941, *Maas G. 1197* (L); Lemele, Lemelerberg, 27 VII 1941, *Maas G. 1312* (L); Zwolle, Helmhorst, VII 1916, *Lako* (NBV).

Gelderland: Bennekom, 6 IX 1942, *Maas G. 2205a* (L); Bennekom, Oostereng-Quadenoord, 24 V 1943, *Maas G. 2479* (L); Doetinchem, VIII 1939, *Van Soest* (VS); Doornspijk, 28 X 1941, *Groot & Van Soest 506* (VS); Doornspijk, Nieuw Soerel, 25 IV 1942, *Maas G. 1848, 1866* (L, VS); Harderwijk, *Bondam* (L); Hierden, Hulshorst, 4 IV 1942, *Maas G. 1785a, 1786* (L); 6 IV 1942, *Maas G. 1803* (L); Hierden, Hulshorst-Elspeet, 5 IV 1942, *Maas G. 1798* (L); Hoenderloo-Beekbergen, Spelderholt, 28 III 1943, *Maas G. 2376* (L); Hoenderloo-Uchelen, 26 III 1943, *Maas G. 2333,* transition to f. *farinosa* (L); Leuvenum, 27 X 1941, *Maas G. 1714* (L); Nijkerk, 24 II 1866, *Stolz* (L); 31 III 1866, *Stolz* (NBV); Oldebroek, VIII 1939, *Van Soest 117* (VS); Renkum, *Buse* (L, NBV); VII 1848, *Buse & Buse-Koppiers,* transition to f. *farinosa* (L, NBV); Speulde, 28 V 1939, *Nannenga 828* (Nga); Ubbergen, III 1850, *Abeleven* (L); Velp, 1845, *Van der Sande Lacoste* (NBV); Wageningen, *Buse & Buse-Koppiers* (NBV).

Utrecht: Baarn-Hilversum, 28 II 1943, *Maas G. 2279* (L); Driebergen, *Van Hall* (NBV); Leersum, Darthuizen, 30 VI 1849, *Van Hall* (NBV); Loosdrecht, 1847, *Van der Sande Lacoste* (NBV); Maarn, 6 V 1922, *Ten Kate* (L); Rijzenburg, *Bondam* (NBV); Utrecht, Prins Hendrikoord, 12 II 1920, *Hart de Ruyter* (U); De Vuursche, Hollandsche Rading, 9 VII 1933, *Nannenga 84* (Nga); De Vuursche, Lage Vuursche, 9 IV 1944, *Agsteribbe* (L).

Noord-Holland: Alkmaar, Heilooër bosch, 18 IX 1943, *Barkman 500* (L); Bergen, 20 IX 1943, *Barkman 603* (L); Callantsoog, Zwanenwater, 23 V 1941, *Schroevers* (L); Heemskerk, III 1942, *Prud'homme van Reine* (L); Overveen, 1839, *Buse & Gildemeester-Buse,* transition to f. *farinosa* (L); VII 1840, *Buse & Gildemeester-Buse* (NBV); Terschelling, Koegelwieck, 24 VIII 1938, *Nannenga 1081* (Nga); 5 V 1946, *Westhoff 46111a* (L); Vogelenzang, *Buse* (L).

Zuid-Holland: 's Gravenhage, 5 X 1940, *Maas G. 20* (L); 's Gravenhage-Wassenaar, 13 VII 1941, *Maas G. 1084b* (L); Lisse, Keukenhof, 30 VII 1942, *Van Rossem 286, 289* (L); Wassenaar, Meiendel, 13 VII 1941, *Maas G. 1083* (L); 12 X 1941, *Maas G. 1533* (L, U).

Zeeland: Walcheren, Oostkapelle, 25 V 1946, *Brakman,* isidiferous (L).

Noord-Brabant: Beek, VIII 1847, *Van den Bosch* (L); Bergen op Zoom-Woensdrecht, 11 XI 1943, *Maas G. 2894* (L); Heeswijk, 11 IX 1934, *Nannenga 499* (Nga); Oisterwijk, Gemullehoeken, 15 XI 1943, *Barkman 691* (L); Oisterwijk, Logtsche heide, 25 VII 1943, *Maas G. 2604* (L).

f. **farinosa** Hillm. in Verh. Bot. Ver. Prov. Brandenburg, vol. 65, 1923, p. 64 et in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 75; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 569 et vol. 10, 1940, p. 539.

Iconography: Bitter in Jahrb. wiss. Bot., vol. 36, 1901, tab. 9, fig. 30.

Lobes, especially the soraliferous ones, with more or less wrinkled upper surface or even warty-isidiate towards the centre of the thallus. Rugosities and warts bursting, and becoming sorediose, with the soredia finally more or less covering the lobes.

Ecology and frequency. Occurring together with *f. tubulosa,* but much rarer.

Remarks. This form is not unlike a sorediate form of *P. physodes* var. *subcrustacea,* but the head-shaped soralia procure a decisive distinguishing mark, both to the last-named species and to *P. bitteriana* to which strongly sorediate forms of *farinosa* bear a striking resemblance.

In Ann. Mycol., vol. 36, 1938, p. 149, Erichsen describes as a new variety var. *subbitteriana.* Though war conditions made it impossible to have the material sent to me, the description makes it highly probable that *subbitteriana* is nothing but f. *farinosa.*

Drente: Bronneger, 6 V 1941, *Maas G. 972a* (L); Diever, 10 V 1941, *Maas G. 1130c* (L); Emmen, Westenesch, 8 V 1941, *Maas G. 1091b* (L).

Gelderland: Bennekom, 6 IX 1942, *Maas G. 2205b* (L); Doornspijk, Nieuw Soerel, 25 IV 1942, *Maas G. 1848a* (L, VS); Hierden, Hulshorst, 4 IV 1942, *Maas G. 1785b* (L); 6 IV 1942, *Maas G. 1802* (L); Hoenderloo-Beekbergen, Spelderholt, 28 III 1943, *Maas G. 2390* (L).

Utrecht: Vleuten-Harmelen, 7 IX 1943, *Maas G. 2781* (L).

Zuid-Holland: Wassenaar, Meiendel, *Verploegh* (U).

Subgenus 2. EUPARMELIA Nyl.

apud Hue in Rev. de Bot., vol. 4, 1885/1886, p. 375; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 57 et vol. 10, 1940, p. 503 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 90.

Lower side of the thallus more or less rhizinose, or at least with warts, more rarely almost glabrous.

Key to the sections.

1a. Thallus fruticose, at least partly. Lower side canaliculate, wrinkled or veined, sparingly rhizinose . . . . sect. 1. EVERNIIFORMES
1b. Thallus foliaceous, growing in rosettes or wide-spreading, appressed or ascendent. Lower side densely rhizinose, at least in the centre of the thallus . . . 2
  2a. Thallus usually dark-coloured, olive-green, green-brown, yellow-brown, dark brown to almost black. Lower side rhizinose or warted up to the very tips of the lobes, or with a narrow bare zone . . sect. 3. MELAENOPARMELIA
  2b. Thallus differently coloured 3
    3a. Thallus grey, bluish grey, grey-green (sometimes stained with rusty red) 4
      4a. Lower side of the lobes densely rhizinose or warted up to the very tips, or with a narrow bare zone . . . sect. 5. HYPOTRACHYNA
      4b. Lower side with a broad bare zone at the tips of the lobes sect. 6. AMPHIGYMNIA
    3b. Thallus yellow-green or yellow-grey 5
      5a. Lobes usually narrow, richly branched. Tips of the lobes with a narrow bare zone beneath . . . . . . sect. 4. XANTHOPARMELIA
      5b. Lobes usually broad, incised, rather than branched. Tips of the lobes with a broad bare zone beneath . . . sect. 6. AMPHIGYMNIA

Remarks. Section 2. *Teretiusculae* is not native in Holland.

Sectio 1. EVERNIIFORMES Hue

in Nouv. Arch. Mus., ser. 4, vol. 1, 1899, p. 135; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 57 et vol. 10, 1940, p. 503 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 90.

Thallus fruticose, at least partly. Lobes ascendent or pendulous, more rarely forming rosettes, usually elongate and somewhat narrow, canaliculate beneath, wrinkled or veined, sparingly rhizinose.

Remarks. As may be gathered from the paragraph dealing with the orthography of names (Briquet, Internat. Rules of Bot. Nomenclat., ed. 3, 1935, Recommend. 44), both *Everniaeformes* as written by Zahlbruckner and *Everniformes* as written by Hillmann are incorrect.

5. **Parmelia furfuracea** (L.) Ach., Meth. Lich., 1803, p. 254; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 61; vol. 8, 1932, p. 558 et vol. 10, 1940, p. 518 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 91 — *Lichen furfuraceus* L., Spec. Pl., vol. 2, 1753, p. 1146 — *Evernia furfuracea* Mann, Lich. Bohem. Observ. Dispos., 1825, p. 105 (non vidi); Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 119; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 10.

Macroscopical description. Thallus foliaceous to almost fruticose, patent or pendulous, sometimes with a few basal, closely adnate lobes growing in a rosette, attached to the substratum by means of the basal parts of the lower side, and of a few rhizinae, deeply incised. Lobes dorsiventrally flattened, somewhat soft, up to about 5 cm long, (very much longer in the mountainous regions of Europe) 1—4 mm broad, for a large part free from the substratum, discrete though more or less entangled, richly and divaricately or irregularly branched, convex. Margins, as a rule, for the greater part rolled inwards, entire. Tips acute or furcate. Upper side of the lobes pale grey, bluish grey, ash-grey to dark grey, with tanned apex, entirely dull, smooth to irregularly dented, sometimes with cortical cracks, isidiate, and in one case sorediate. Isidia laminal (sometimes on the lower surface as well) and marginal, concolorous with the upper surface, varying from minute and papillary (isidia verruciformia) to elongated and simple or branched (isidia cylindrica), scattered or more or less crowded, easily breaking off. Lower side of the lobes either entirely black, sometimes with a bluish hue, or black in the centre and turning vinaceous, flesh-coloured or white towards the tips, dull, canaliculate except at the tips, wrinkled or reticulately veined, very sparingly rhizinose. Rhizinae short, pale or dark. *Microscopical description.* Upper cortex colourless, with a dark exterior zone, paraplectenchymatous, 12—30 μ. Gonidia bright green, spherical, 10—17 μ, arranged in clusters or in a continuous layer of 30—60 μ. Medulla colourless, white in reflected light, or faintly reddish, more or less densely plectenchymatous, 100—300 μ, composed of mesodermatous hyphae. Lower cortex brownish or black, paraplectenchymatous, 20—30 μ. *Apothecia* and *pycnidia* not observed in this country.

Chemical reactions. Upper cortex K + yellow, C —, KC + yellow, Pd + slowly chrome-yellow. Medulla K —, C — or + red, KC + flesh-coloured, then turning brown-red, Pd —. The chemical constituents will be dealt with under the varieties.

Distribution. Widely distributed all over Europe.

Remarks. *Parmelia furfuracea* is a variable species of which a number of varieties have been described mainly based on morphological differences. Another subdivision, mainly based upon chemical principles, was elaborated by Zopf who in his treatise (in Beih. Bot. Centralbl., vol. 14, 1903, p. 95—126) split up the original *furfuracea* into 5 species, viz. *furfuracea, ceratea, soralifera, isidiophora,* and *olivetorina.* Later on (in Ber. Deutsch. Bot. Ges., vol. 23, 1905, p. 498), a sixth was added, viz. *ericetorum.* Now, the latter as well as *soralifera* may be left out of consideration here, since they do not occur in this country. About the others the following may be said. Any species is characterised by a set of morphological, anatomical, and chemical properties. On many occasions we have learned to consider the morphology of a lichen a result of the influence of external factors, and in many cases seemingly widely divergent phases appear to be a variety or a forma. The same factors, however, may affect the metabolism and the yield of lichen acids resulting therefrom as well, so why should we not look upon any specimen differing in its content of lichen acids as a variety? It is here that we enter upon too complex and unknown a territory to feel entitled to hamper taxonomy by creating new species merely on the basis of chemical differences!

Of course, the chemically based taxonomist might reproach the one who holds to morphological characters his one-sidedness, but then a morphological property seems a factor of primary importance, whereas a chemical property need not necessarily be so. A similar view was recently expressed by Santesson (in Ark. f. Bot., vol. 30A, 1943, no. 10, p. 8).

It has sometimes been, and, in some cases, it still seems to be overlooked that lichens are compound organisms, composed of a fungus and an alga. Now, the chemical differences between *furfuracea — isidiophora — olivetorina* might very well be caused by differences due to the algal component, a possibility which certainly would be well worthy of being studied more closely. But even if racial or varietal differences of the gonidia would account for the lichens being chemically different, I still don't deem this a reason for calling *furfuracea, isidiophora,* and *olivetorina* separate species. To my mind, the fungous component has a greater taxonomical importance than the algal part, a view already put forward by Degelius (in Uppsala Univ. Årsskr., 1939, no. 11, p. 98) and by Nannenga (in Rec. Trav. Bot. Néerland., vol. 36, 1939, p. 538—542).

Not being a chemist I will refrain from judging the chemical work by Zopf, yet I object to his method of creating new species. About *furfuracea* Zopf writes (in B. B. C., p. 99): "Was die Gestaltungsweise des Thallus betrifft, so ist es von ausserordentlicher Schwierigkeit, wenn nicht unmöglich, eine prägnante Charakteristik zu liefern..." Concerning *isidiophora* (l. c. p. 105) we read: "Es ist hier, der relativ grossen Variabilität wegen, unmöglich, eine scharfe Charakteristik des Thallus zu geben...", and a few lines farther: "... zu einer völlig sicheren Erkennung wird man aber wohl stets die chemische Untersuchung mit in Anwendung bringen müssen". This clearly emphasises the great similarity of both "species", to say nothing of their being identical. Did Zopf study the chemistry of the type material of *Lichen furfuraceus* (and of var. *scobicina*)? I am sure he didn't, since a chemical analysis would have meant a total loss of the material! But then, how could he make sure that the original specimens were, perchance, not *isidiophora*! By the courtesy of Mr Savage's, assistant-secretary of the Linnean Society of London, it was my privilege to obtain a photograph of the Linnean type of *furfuracea*, and on comparing it with the less scobinate forms of *isidiophora* pictured by Zopf I was actually unable to find any morphological difference. Properly speaking, we need not even acknowledge a variety which is based upon a mere assumption, but in the meantime we have to consider the fact that there do exist varieties of *furfuracea* which differ chemically, and it would be worth while to elaborate a method for demonstrating microchemically the lichen acids characteristic of those varieties.

Judging from the greenish ether extract, there are no specimens of var. *furfuracea* in this country, which seems a peculiar fact. This conclusion might, however, be explained by the difficulty to discriminate on the basis of a pale and vaguely shaded liquid extracted from too small a quantity of material available for analysis.

If, in the following lines, I nevertheless mention Zopf's chemical varieties, I am doing so with great reserve, since the difference of var. *isidiophora* and var. *olivetorina* from var. *furfuracea* and var. *scobicina* is still doubtful. Hillmann (l. c. p. 103) hinted at the use of the conception "formae reagentes" though he never went so far as to carry it through.

The two following keys inevitably partly overlap.

Key to the "morphological varieties".

1a. Lobes elongate, narrow, repeatedly divaricately branched; isidia numerous but very short, somewhat wart-like . . . . var. **ceratea** Ach.
1b. Thallus different, isidia usually longer 2
  2a. Isidia more or less developed though not branched and coralloid, and not densely packed. Lobes without secondary laciniae var. **furfuracea** Maas G.
  2b. Thallus different 3
    3a. Isidia long, branched, often coralloid, closely packed var. **scobicina** Ach.
    3b. In between the isidia there are pale grey secondary folioles var. **microphylla** Erichs.

Key to the "chemical varieties".

1a. Medulla C + red 2
  2a. Isidia short, papillary var. **olivetorina** (Zopf) Hillm. f. **eu-olivetorina** Maas G.
  2b. Isidia, at least a number of them, long, branched and crowded var. **olivetorina** (Zopf) Hillm. f. **scobinosa** Hillm.
1b. Medulla C — 3
  3a. Ether extract of the thallus reddish 4
    4a. Lobes elongate, narrow, repeatedly divaricately branched; isidia very short, papillary . . . . var. **ceratea** Ach.
    4b. Thallus different; isidia longer . . . . . var. **furfuracea** Maas G.
  3b. Ether extract of the thallus green . . var. **isidiophora** (Zopf) A. Zahlbr.

var. **furfuracea** Maas G. nov. var.

Typus: the same as the type of *Lichen furfuraceus*.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 21, fig. 9; Bitter in Jahrb. wiss. Bot., vol. 36, 1901, tab. 11, fig. 54; Cretzoiu in Inst. Cercetar. Experim. Forest., ser. 2, vol. 47, 1941, tab. 7, fig. 2; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 4, fig. a;

Harm., Lich. France, vol. 4, 1909, tab. 14, fig. 1; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, fig. 5, 6; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 12, fig. 1; Smith et Sowerb., Engl. Bot., vol. 14, 1802, tab. 984; Zopf in Beih. Bot. Centralbl., vol. 14, 1903, tab. 3—5 et in Ber. Deutsch. Bot. Ges., vol. 23, 1905, tab. 21.

Thallus bene evolutus, isidiis munitus. Isidia nec conferta, nec ramosa.

Thallus well developed, isidiate. Isidia neither closely packed, nor branched or coralloid.

Chemical constituents and reactions. Medulla unaltered by C. In var. *furfuracea* Zopf (Flechtenstoffe, 1907, p. 226, 268, 419, and in Beih. Bot. Centralbl., vol. 14, 1903, p. 103, 122) identified atranorin ($C_{19}H_{18}O_8$), physodic acid ($C_{20}H_{22}O_6$), and furfuracic acid. The ether extract from the thallus is reddish yellow, partly due to this furfuracic acid, and partly to an unknown resinous acid.

Ecology. On deciduous and coniferous trees, sometimes also on siliceous boulders.

Remarks. I have rarely seen var. *furfuracea* in Holland, most of the specimens found being intermediate between this and other varieties.

Groningen: Haren, IV 1941, *Stafleu*, transition to var. *scobicina* (U); Ter Apel, I 1907, *Tresling* (TA).

Drente: Dwingelo, 31 VII 1941, *Maas G. 1409a*, transition to var. *ceratea* (L); Rolde, V 1849, *Van den Bosch* (NBV).

Gelderland: Apeldoorn, 't Loo, 1 VIII 1854, *Van der Sande Lacoste* (L, NBV); Doetinchem, VIII 1939, *Groot & Van Soest 617* (VS); Garderen, 4 I 1940, *Stafleu* (U); Hierden, Hulshorst, 24 X 1941, *Maas G. 1566* (L); Leuvenum, Leuvenumsche bosch, 25 X 1941, *Maas G. 1601a*, transition to var. *scobicina* (L); Nunspeet, VII 1891, *Top* (NBV); Nijmegen, 25 IX 1873, *Van Hall* (Gro); Nijmegen, Meerwijk, VII 1873, *Van Hall* (Gro, NBV); 25 VII 1873, *Van Hall* (L); Renkum, *Buse & Buse-Koppiers* (NBV); Rozendaal, *Buse & Buse-Koppiers* (Gro, NBV); Terlet, IV 1919, *Florschütz* (U).

Utrecht: Baarn, 10 VI 1887, *Wakker* (L); Bilthoven, 2 IV 1919, *Ten Kate*, transition to var. *ceratea* (L); De Bilt, 8 III 1930, *Wassink 226* (Wask); De Vuursche, Lage Vuursche, 10 VII 1933, *Nannenga 86* (Nga); De Vuursche, Lage Vuursche-Hilversum, 10 VII 1933, *Nannenga 87* (Nga); Maartensdijk, Eyckestein, 22 II 1941, *Stafleu*, transition to var. *microphylla* (U); Utrecht, Groenekan, 26 II 1928, *Wassink 3350* (Wask).

Limburg: Epen, Eperheide, 8 VII 1942, *Van Rossem 188*, transition to var. *scobicina* (L); Maastricht, *Franquinet* (Maastr.); *Franquinet*, transition to var. *scobicina* (L).

var. **ceratea** Ach., Meth. Lich., 1803, p. 255; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 66; vol. 8, 1932, p. 558 et vol. 10, 1940, p. 518 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 98.

Iconography: Howe in Bot. Gazette, vol. 51, 1911, tab. 25, fig. 6 (Acharian type), fig. 7 (not very conspicuous).

Lobes elongate, narrow, repeatedly and divaricately branched. Tips acute. Lower side canaliculate. Isidia from almost lacking to numerous but very short, rather papillary.

Chemical constituents and reactions. As stated by Zopf (l. c.), var. *ceratea* is quite similar to var. *furfuracea* in chemical respect; the ether extract is reddish.

Ecology and frequency. Most probably var. *ceratea* is a hygrophilous variety, and this accounts for its rareness in Holland, where habitats are either damp but too heavily shaded to permit any lichen growth, or in bright day-light but too dry for so sensitive plants as certain lichens are.

Gelderland: Hierden, Hulshorst-Leuvenum, 28 IV 1919, *Ten Kate* (L); Hoenderloo, De Hooge Veluwe, 3 XI 1946, *Maas G. 3446* (L); Renkum, *Buse & Buse-Koppiers* (NBV).

var. **scobicina** Ach., Meth. Lich., 1803, p. 255; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 69; vol. 8, 1932, p. 559 et vol. 10, 1940, p. 519 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 100.

Iconography: Reinke in Jahrb. wiss. Bot., vol. 28, 1895, p. 393, fig. 113.

Lobes densely isidiferous. Isidia, at least a number of them, long, branched, often coralloid.

Remarks. Typical *scobicina* seems to be rare in this country, but perhaps it has been enumerated under var. *isidiophora* (see there).

Gelderland: Leuvenum, Leuvenumsche bosch, 25 X 1941, *Maas G. 1601b* (L).
Noord-Brabant: Oisterwijk, Logtsche heide, 25 VII 1943, *Maas G. 2605* (L).

var. **microphylla** Erichs. in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 12; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 559 et vol. 10, 1940, p. 519; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 100.

Notable for its pale-coloured, clavate excrescences which develop into folioles contrasting with the old dark branches.

Remarks. This is a variety most probably due to its being exposed to the wind, as already supposed by Erichsen. The reaction upon the usual chemicals has not been taken into account.

Drente: Drouwen-Borger, 7 V 1941, *Maas G. 1009* (L); Dwingelo, 31 VII 1941, *Maas G. 1409b* (L).
Overijsel: Lemele-Dalfsen, 27 VII 1941, *Maas G. 1350* (L).
Gelderland: Hierden, Hulshorst, 25 X 1941, *Maas G. 1597* (L).

var. **isidiophora** (Zopf) A. Zahlbr. in Ann. K. K. Naturhist. Hofmus. Wien, vol. 18, 1903, p. 369; Cat. Lich. Univ., vol. 6, 1929, p. 68; vol. 8, 1932, p. 559 et vol. 10, 1940, p. 519 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 99 — *Evernia isidiophora* Zopf in Beih. Bot. Centralbl., vol. 14, 1903, p. 105.

Iconography: Zopf in Beih. Bot. Centralbl., vol. 14, 1903, tab. 3, fig. 1—8.

Differs from var. *furfuracea* and var. *scobicina* in chemical respect.

Chemical constituents and reactions. According to Zopf (l. c. p. 107, 122, as well as Flechtenstoffe, 1907, p. 226, 268, 419), there are atranorin ($C_{19}H_{18}O_8$), physodic acid ($C_{20}H_{22}O_6$), and isidic acid, whereas furfuracic acid and olivetoric acid are lacking. The ether extract is green.

Remarks. It may be gathered from Zopf's description that *isidiophora* includes both almost glabrous and isidiferous plants. It is quite possible, therefore, that plants morphologically belonging to var. *scobicina* are being enumerated here on account of the ether extract which invariably is of a greenish yellow colour.

Groningen: Winschoten, Oostereind, 30 XII 1936, *Nannenga 650* (Nga).
Drente: Anlo, 3 V 1941, *Maas G. 764* (L); Dwingelo, 31 VII 1941, *Maas G.*

1409 (L); 1 VIII 1941, *Maas G. 1452* (L); Eext, 5 V 1941, *Maas G. 897* (L); Hoogeveen, 29 VIII 1942, *Lütjeharms 64c* (L).

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1140* (L); Hellendoorn, 26 VII 1941, *Maas G. 1287* (L); Holten, 25 VII 1941, *Maas G. 1279* (L).

Gelderland: Apeldoorn, 't Loo, 19 VIII 1849, 1 VIII 1854, *Van der Sande Lacoste* (L); Bennekom, Hullenberg, 6 IX 1942, *Maas G. 2210* (L); Doornspijk, Nieuw Soerel, IV 1942, *Maas G. & Van Soest* (VS); 25 IV 1942, *Maas G. 1849, 1857* (L); Doornspijk, Soerel, 25 IV 1942, *Maas G. 1862* (L); Ellekom, Hagenau, 8 VIII 1942, *Van Rossem 265* (L); Elspeet, Elspeeter bosch, 27 X 1941, *Maas G. 1717, 1725* (L); Hierden, Hulshorst, 23 VII 1934, *Kruyt* (L); Hoenderloo, VIII 1941, Miss *Lusink* (L); Hoenderloo-Beekbergen, Spelderholt, 28 III 1943, *Maas G. 2382* (L); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2354b, 2359* (L); Hoog Soeren, Soerensche bosch-'t Loo, 19 VIII 1849, unio NBV (NBV); Leuvenum, Leuvenumsche bosch, 26 X 1941, *Maas G. 1663* (L); 6 IV 1942, *Maas G. 1809b* (L); Nijmegen, 25 IX 1873, *Van Hall* (L, U); Nijmegen, Meerwijk, 25 VII 1873, *Van Hall* (L); Renkum, *Buse & Buse-Koppiers*, transition to var. *ceratea* (NBV); Ruurlo, 10 IX 1935, *Nannenga 545* (Nga); Speulde, 28 V 1939, *Nannenga 811* (Nga); Winterswijk, VIII 1939, *Insje 616, 618* (VS); Wolfheze, *Buse* (L).

Utrecht: Austerlitz, Pyramide, 1 VII 1934, *Nannenga 363* (Nga); 13 VI 1936, *Nannenga 612* (Nga); Baarn, 2 IV 1944, *Agsteribbe* (L); Bilthoven, 18 VI 1933, *Nannenga 23* (Nga); De Bilt, 8 III 1930, *Wassink 223* (Wask); De Vuursche, Lage Vuursche, 9 IV 1944, *Agsteribbe* (L); Maarn, 6 V 1922, *Ten Kate* (L); Maartensdijk, Eyckestein, 15 II 1941, *Nannenga 1099* (Nga); Soestdijk, 28 VII 1880, *Van der Sande Lacoste* (NBV); 25 I 1920, *Hart de Ruyter* (U); Utrecht, Groenekan-Bilthoven, 25 V 1941, *Nannenga 1167* (Nga); Zeist, V 1909, *Brakman* (L); 20 V 1934, *Nannenga 344* (Nga).

Noord-Holland: Texel, Fonteinsnol, 12 V 1942, *Stafleu* (U).

Zuid-Holland: Oud Ade, 21 VIII 1943, *Maas G. 2751* (L).

Noord-Brabant: Bergen op Zoom-Woensdrecht, 11 XI 1943, *Maas G. 2912* (L); Boxtel-Best, Veldersbosch, 14 XI 1943, *Barkman 674* (L); Boxtel-Oisterwijk, 12 V 1901, *Wakker* (L); Breda, Ulvenhoutsche bosch, 9 XI 1943, *Barkman 665* (L); Oisterwijk, Gemullehoeken, 15 XI 1943, *Barkman 689* (L); Oisterwijk, Logtsche heide, 23 VII 1943, *Maas G. 2613* (L); Ulvenhout-Strijbeek, 10 XI 1943, *Barkman 664* (L).

var. **olivetorina** (Zopf) Hillm. in Verh. Bot. Ver. Prov. Brandenburg, vol. 65, 1923, p. 65 et in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 101; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 68; vol. 8, 1932, p. 559 et vol. 10, 1940, p. 519 (ubi lit. et synon.) — *Evernia olivetorina* Zopf in Beih. Bot. Centralbl., vol. 14, 1903, p. 110.

Thallus variable, resembling either var. *ceratea*, var. *furfuracea* or var. *scobicina*, but differing from these in that its medulla is stained red with C.

Chemical constituents. According to Zopf (l.c. p. 114, 122, and Flechtenstoffe, 1907, p. 152, 226, 419), this variety contains atranorin ($C_{19}H_{18}O_8$) and olivetoric acid ($C_{27}H_{36}O_8$), the latter being responsible for the red C-reaction of the medulla. As Asahina and his collaborators pointed out (Ber. Deutsch. Chem. Ges., vol. 65B, 1932, p. 475; vol. 68B, 1935, p. 2026; Act. Phytochim., vol. 8, 1934, p. 36), the formula of olivetoric acid is $C_{26}H_{32}O_8$.

Remarks. Var. *olivetorina* I have frequently found growing mixed with var. *isidiophora* on the same tree. In all these cases no difference could be detected before a drop of C was applied to the medulla, and this makes one thinking. On the one hand, it may be deemed definitely settled that *isidiophora* and *olivetorina*, differing chemically even under similar conditions, are quite different, on the other, one might maintain that the formation of olivetoric acid (in *olivetorina*), and of physodic acid and isidic acid (in *isidiophora*) may prove to be of a reversible nature, so that *isidiophora* and *olivetorina* may be considered slight modifications only.

var. **olivetorina** f. **eu-olivetorina** Maas G. nov. f.

Typus: the same as of *Evernia olivetorina*.

Iconography: Schenk in Karsten et Schenk, Vegetationsbild., vol. 12, pars 5, 1914, tab. 26; Zopf in Beih. Bot. Centralbl., vol. 14, 1903, tab. 4, 5 et in Ber. Deutsch. Bot. Ges., vol. 23, 1905, tab. 21, fig. sup.

Thallus isidiis papilliformibus munitus.

Thallus more or less isidiate. Isidia papillary.

Drente: Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld 7520, 7522* (L); 7 V 1941, *Maas G. 1061, 1064* (L).

Gelderland: Apeldoorn, 't Loo, VIII 1849, unio NBV (NBV); Apeldoorn-Soerensche bosch, VIII 1849, unio NBV (NBV); Doornspijk, 25 IV 1942, *Maas G. 1835* (L); Doornspijk, Nieuw Soerel, 25 IV 1942, *Maas G. 1855* (L); Ede, Nieuw Reemst, *Buse & Buse-Koppiers* (NBV); Groesbeek, 15 VIII 1869, *Van Hall* (NBV); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2354a, 2359a* (L); Leuvenum, Leuvenumsche bosch, 6 IV 1942, *Maas G. 1809a* (L); Renkum, *Buse* (L); Uddel, Uddeler meer-'t Loo, VIII 1849, *Abeleven* (NBV).

Utrecht: De Bilt, 16 I 1930, *Wassink 3354* (Wask); Soestdijk, 25 I 1920, *Hart de Ruyter* (U).

Zuid-Holland: Wassenaar, Meiendel, 13 VII 1941, *Maas G. 1082* (L).

Noord-Brabant: Boxtel-Oisterwijk, 12 V 1901, *Wakker* (L).

var. **olivetorina** f. **scobinosa** Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 102; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 519.

Iconography: Zopf in Ber. Deutsch. Bot. Ges., vol. 23, 1905, tab. 21, fig. inf.

Differs from f. *eu-olivetorina* in that its lobes are for the most part densely isidiferous, whereas the isidia are elongated and branched.

Remarks. As already stated by Hillmann (l. c. p. 102) this *f. scobinosa* is quite homologous with var. *scobicina*.

Drente: Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld 7521* (L).

Gelderland: Apeldoorn, 't Loo, 1849, unio NBV (L, NBV); 1 VIII 1854, *Van der Sande Lacoste* (L); Apeldoorn, 't Loo-Soerensche bosch, 19 VIII 1849, *Van der Sande Lacoste* (L, NBV); Doornspijk, IV 1942, *Maas G. & Van Soest* (VS); 25 IV 1942, *Maas G. 1831* (L); Renkum, *Buse & Buse-Koppiers* (NBV); Uchelen, 30 IV 1939, *Groot & Van Soest 123, 313* (VS); Uddel, Uddeler meer-'t Loo, VIII 1849, *Abeleven* (NBV).

Noord-Brabant: Hilvarenbeek, V 1924, *Smelt* (VD Wijk); Oisterwijk, Logtsche heide, 23 VII 1943 *Maas G. 2621* (L).

Sectio 3. MELAENOPARMELIA Hue em. Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 109; Hue in Nouv. Arch. Mus., ser. 4, vol. 1, 1899, p. 138; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 75 et vol. 10, 1940, p. 503 (ubi lit. et synon.).

Thallus more or less growing in rosettes, appressed. Lobes flat or undulate, either ascending at the margins or not, usually dark-coloured, varying from olive-green, yellow-brown to dark brown or almost black. Lower side rhizinose or warted up to the very tips or with a narrow bare zone.

Remarks. Contrary to Zahlbruckner's quotation (c. f. his Cat. Lich. Univ., vol. 6, 1929, p. 75), Hue subordinated this section to subgenus

Eu-Parmelia. It should be pointed out, however, that Hue, on establishing the section, conceived it in a much more limited sense than Hillmann did. This may be elucidated by the fact that a great deal of the species which today belong to the *Melaenoparmeliae* were formerly assigned to the section *Hypotrachyna*, group *Cyclocheila* by Hue.

By Van den Bosch (in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 126), and by Abeleven (in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 19) *Parmelia olivacea* was reported to be native. Now, the epithet *olivacea* has a long time been misused as a collective name for all kinds of brown *Parmeliae*, but the real *P. olivacea* sensu Nylander is unknown from this country.

Key to the species.

1a. Thallus esorediate, without isidia, and without warts (not to be confused with warty pycnidia!), at most wrinkled and seemingly warty in the centre . . 2

2a. Medulla C + red. Thallus appressed. Lobes olive-coloured, shiny **12. P. fuliginosa** (Fr.) Nyl. var. **glabratula** (Lamy) Oliv.

2b. Medulla C — 3

3a. Medulla K —, Pd — 4

4a. Lower surface black, turning brown towards the tips of the lobes. Saxicolous . . . . **7. P. prolixa** (Ach.) Malbr.

4b. Lower surface pale brown. Lobes laciniate or beset with folioles. Arboricolous . . . . . . **9. P. laciniatula** (Flag.) A. Zahlbr.

3b. Medulla K + yellow, slowly turning brown-red, Pd + yellow, turning orange. Thallus large . . . . . **6. P. acetabulum** (Neck.) Duby

1b. Thallus sorediate or isidiate or warty 5

5a. Thallus without soralia; warts or isidia not becoming sorediose . . . 6

6a. Medulla Pd + yellow, turning orange. Centre of the thallus strongly wrinkled or with warts or papillae **6. P. acetabulum** (Neck.) Duby var. **glomerata** Hillm.

6b. Medulla Pd — 7

7a. Lower surface whitish or pale brown 8

8a. Thallus at the tips of the lobes with warts which, towards the centre, grow out into long, cylindrical, usually branched, and more or less crowded isidia **11. P. elegantula** (A. Zahlbr.) Szat.

8b. Thallus with warts which may develop into clavate or spatulate outgrowths or into folioles 9

9a. Warts confined to the tips of the lobes, developing into folioles towards the centre. Margins strongly crenulate or beset with folioles. Lower cortex thinner than the upper one . . . . **9. P. laciniatula** (Flag.) A. Zahlbr.

9b. Warts occurring all over the thallus, developing into clavate or spatulate isidia. Margins of the lobes more or less crenulate, but not beset with folioles. Lower cortex thicker than the upper one. . . . . **10. P. exasperatula** Nyl.

7b. Lower surface black, turning brown only at the tips of the lobes 10

10a. Thallus warted only. Warts pitted at their apex or even perforated. Medulla C — . . . . **8. P. aspera** Mass.

10b. Thallus warted as well as isidiate. Warts different from the above. Medulla C + red 11

11a. Upper side dark olive-brown to greenish black **12. P. fuliginosa** (Fr.) Nyl.

11b. Upper side pale olive-coloured green or brown . . . 12

12a. Isidia long, densely crowded and giving the thallus a shaggy appearance
12. **P. fuliginosa** (Fr.) Nyl. var. **laetevirens** Flot. ex Nyl.
12b. Thallus almost destitute of isidia
12. **P. fuliginosa** (Fr.) Nyl. var. **glabratula** (Lamy) Oliv.

5b. Thallus with soralia, or with structures deceivingly resembling soredia, since the isidia easily break off, thus showing their white medulla . . . 13
13a. Medulla C + red 14
14a. Thallus with small warts only which may burst and become sorediose
15. **P. subaurifera** Nyl.
14b. Thallus with warts as well as with longish isidia 15
15a. Lower surface black, turning brown towards the tips of the lobes 16
16a. Warts at the tips of the lobes small, more rarely mixed with broad ones. Lobes shiny at the tips 17
17a. Upper side dark brown 12. **P. fuliginosa** (Fr.) Nyl.
17b. Upper side olive-coloured
12. **P. fuliginosa** (Fr.) Nyl. var. **laetevirens** Flot. ex Nyl.
16b. Warts at the tips of the lobes minute, together with broad, dark and coarse ones (initial phases of soralia!). Lobes less shiny or quite dull
15. **P. subaurifera** Nyl. f. **fuliginoides** (Bouly de Lesd.) A. Zahlbr.
15b. Lower surface pale brown
11. **P. elegantula** (A. Zahlbr.) Szat. var. **isidioidea** (Oliv.) Hillm.
13b. Medulla C — 18
18a. Upper cortex C —, N + red-brown 19
19a. Lower side of the thallus black, dull. Isidia short, coralloid, congregated into more or less isolated, cushion-shaped clusters
14. **P. disjuncta** Erichs.
19b. Lower side pale brown, shiny. Isidia long, more evenly covering the thallus . . . . . . 11. **P. elegantula** (A. Zahlbr.) Szat.
18b. Upper cortex C + bluish grey, N + bluish violet, turning grey
13. **P. isidiotyla** Nyl.

6. **Parmelia acetabulum** (Neck.) Duby in De Cand. et Duby, Bot. Gall., ed. 2, vol. 2, 1830, p. 601; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 126; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 75; vol. 8, 1932, p. 553 et vol. 10, 1940, p. 504 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 111 — *Lichen acetabulum* Neck., Delic. Gallo-Belg. Silv., vol. 2, 1768, p. 506 (non vidi) — *Imbricaria acetabulum* D.C. in Lam. et De Cand., Fl. Franç., ed. 3, vol. 2, 1805, p. 392; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 18.

Macroscopical description. Thallus foliaceous, middle-sized to large, up to 20 cm in diam., growing in rosettes or wide-spreading, more or less closely appressed, attached to the substratum by means of rhizinae, incised. Lobes dorsiventrally flattened, rather stiff, up to 8 mm broad, usually wavy or strongly folded, contiguous or overlapping, irregularly incised. Margins ascending, undulate or even crispate, especially in the centre of the thallus, sometimes entire, but usually more or less coarsely crenate. Tips appressed or somewhat raised, rounded or broadly lobate. Upper side of the lobes varying from dark green to pale or dark olive, often turning darker to blackish towards the centre of the thallus, dull or somewhat shiny at the tips, sometimes also pruinose, either smooth, wrinkled, papillate or covered with thick folioles, without soredia. Lower surface of the lobes in the centre black or brownish, dull, with numerous dark or pale rhizinae, at the tips grey-yellow or greenish, dull or faintly shiny, smooth or irregularly or reticulately veined, with very short rhizinae or warts, frequently with a bare zone. *Microscopical description.* Upper cortex colourless, with a narrow brownish outer zone, paraplectenchymatous, 9—25 μ. Gonidia bright green, spherical, 7—18 (—21) μ, arranged in a dense layer of 30—70 μ. Medulla colourless, white in reflected light, densely plectenchymatous, up to about 130 μ, composed of mesodermatous hyphae. Lower cortex yellowish or brown, paraplectenchymatous, 9—30 μ. *Apothecia* not rare, frequently in fair numbers or even crowded, laminal, shortly pedicellate, at first cup-shaped, afterwards saucer-shaped, ultimately irregularly wavy and torn, up to 2 cm in diam. Amphithecium concolorous with the thallus, dull, coarsely ridged and warted. Warts at their apices or entirely destitute of a cortex, showing the white medulla (pseudocyphellae!). Margin crenulate and warted, eventually receding. Disc flesh-coloured to dark brown, dull or somewhat shiny, epruinose, smooth or wrinkled, finally folded. Epithecium brownish, hymenium colourless, hypothecium colourless, with a broad gonidial layer underneath. Hymenium 60—75 μ. Asci clavate, 12—18 × 40—50 μ, octosporous. Spores colourless, ellipsoidal or oval, rather thick-walled, 7—9 × 15—17 μ. Paraphyses simple or somewhat furcate, septate, conglutinate, little incrassate at their apices. *Pycnids* very common and occurring in great numbers, laminal, visible as black dots or pits, towards the centre frequently becoming verrucose, spherical or pyriform, up to 180 μ in diam. Perifulcrium colourless or dark, ostiolum dark brown. Pycnoconidia colourless, cylindrical, straight, ± 1 × 6—7 μ.

Chemical constituents and reactions. Upper cortex K + yellow, C —, KC —, Pd —. Medulla K + yellow, slowly turning red-brown, C —, KC + brownish, Pd + yellow, turning orange. As stated by Zopf (Flechtenstoffe, 1907, p. 191, 226, 417), this species contains salazic acid ($C_{19}H_{14}O_{10}$). Asahina and Fuzikawa, however, were able to prove that salazic acid is a mistake, and the principle in question is norstictic acid ($C_{18}H_{12}O_9$) instead (Ber. Deutsch. Chem. Ges., vol. 68B, 1935, p. 946—947; Act. Phytochim., vol. 8, 1934, p. 55). Atranorin is responsible for the yellow colour of the medulla when treated with K. The bitter compound norstictic acid dissolves in K with a red colour, whereas it quickly reacts upon Pd with a bright yellow colour which after a few moments turns into orange.

Distribution. As far as I am able to decide from the data available, *Parmelia acetabulum* is a species that shuns northern latitudes. It is extremely rare in Finland, restricted to the southernmost regions of Scandinavia, not recorded from Latvia (though it occurs in Lithuania), whereas Elenkin's exsiccata (Lich. Fl. Ross., no. 103) have been collected in the southern parts of the U. S. S. R. only, viz. in Sarepta and Serdobsk. In keeping with this distribution, Hillmann (l. c. p. 113) states that *Parmelia acetabulum* does not occur in altitudes higher than 1400 m. On the other hand, it is inexplicable that the species seems to be unknown from Spain and Portugal.

Remarks. As Hillmann (l. c. p. 116) rightly observed, *P. acetabulum* is a transitional case between the sections *Melaenoparmelia* and *Amphigymnia.* Whereas it may be assigned to the latter on account of the bare terminal zone on the lower surface of its lobes, it certainly belongs to the former because of its dark colour.

Occasionally, there may be found specimens with reddish upper surface and medulla which have been described as *Parmelia corrugata* f. *erythropa* Wallr. (1831), and *Parmelia acetabulum* f. *rubescens* Bouly de Lesd. (1912). Hillmann (in Rabenh., p. 114) created the new combination *Parmelia acetabulum* f. *erythropa* (Wallr.) Hillm. Yet, this form can never be put on a par with the others, since it does not represent a reaction of the thallus proper upon some external influence. It is just a chemical process which has taken place in the inside of the thallus, staining it red, and may be caused by any basic liquid, be it the mucus of snails or animal excrements; ordinary calcareous tap-water, too, may bring about the discolouration. Both Hillmann (l. c. p. 114) and Zopf (Flechtenstoffe, 1907, p. 365) point at the possibility of the thallus being contaminated in one of these ways. Rubescent specimens may be found in e. g. var. *glomerata* as well.

The variability of *Parmelia acetabulum* is small, the minor deviations concerning the colour (f. *carneola*) or the pruina (f. *incusa*) of the lobes, or the growth of secondary lobules (f. *microphylla*). More important is the transformation effected by the strongly wrinkled and papillate thallus in var. *glomerata.*

Key to the varieties and forms.

1a. Upper surface of the thallus albo-pruinose var. **acetabulum** Maas G. f. **incusa** (Wallr.) Hillm.
1b. Upper surface epruinose 2
  2a. Thallus dark-coloured 3
    3a. Thallus not covered with folioles 4
      4a. Centre of the thallus at most strongly wrinkled, without true warts (not to be confused with the verrucose pycnidia!) var. **acetabulum** Maas G. f. **eu-acetabulum** Maas G.
      4b. Centre of the thallus strongly folded and wrinkled as well as covered with warts . . . . var. **glomerata** Hillm.
    3b. Thallus more or less densely covered with secondary folioles var. **acetabulum** Maas G. f. **microphylla** Bouly de Lesd.
  2b. Thallus pale olive. . . . . var. **acetabulum** Maas G. f. **carneola** Parr.

var. **acetabulum** Maas G. nov. var.

Typus: the same as of *Lichen acetabulum.*

Thallus superne levis, mox asper vel rugosus mediam partem versus, verrucas simulans.

Upper surface of the lobes smooth, soon becoming uneven or wrinkled, seemingly warty in the centre of the thallus.

var. **acetabulum** f. **eu-acetabulum** Maas G. nov. f.

Typus: the same as of *Lichen acetabulum.*

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 24, fig. 6; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 33; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 21, fig. 1; Smith et Sowerb., Engl. Bot., vol. 23, 1806, tab. 1652; Wulf. in Jacquin, Collect. Bot., vol. 3, 1789, tab. 9, fig. 1; A. Zahlbr. in Engler-Prantl, Die natürl. Pflanzenfam., ed. 2, vol. 8, 1926, tab. 112, fig. C.

Thallus supra fusco-viridis, caesio-viridis, vel olivaceus, epruinosus. Apothecii discus badius vel fuscus.

Upper side of the lobes dark green, bluish green, olive-green or olive-brown, epruinose. Apothecial disc pale to dark brown.

Ecology and frequency. Mainly corticolous, very rarely on boulders (granite), preferably on exposed deciduous trees along roads (elms and oaks), decidedly koniophilous (see for instance the detailed study by Miss Greta Sernander on this species in Svensk Bot. Tidskr., vol. 17, 1923, p. 297—330), and therefore tolerant of the proximity of human dwellings. Fairly common throughout the country.

Groningen: Beerta, Beersterhoogen, 11 VII 1942, *Nannenga 1277* (Nga); Beerta, Ekamp, 28 VII 1941, *Nannenga 1199a*, transition to f. *incusa* (Nga); Beerta, Nieuw Beerta, 22 VIII 1933, *Nannenga 266, 281, 296* (Nga); Groningen, 10 III 1866, *Holkema* (NBV); 3 XII 1866, *Holkema*, c. ap. (Gro, NBV); Haren, *Acker Stratingh* (Gro); 23 IV 1866, 3 XII 1866, *Van Hall*, c. ap. (NBV); Haren, Harendermolen, II 1831, *Van Hall*, c. ap. (NBV); Helpman, *Acker Stratingh*, c. ap. (NBV); Ter Apel, 16 XII 1906, *Tresling* (TA); 30 XII 1906, 6 I 1907, 27 I 1907, II 1907, *Tresling*, c. ap. (TA); VI 1907, *Tresling*, partly transition to f. *incusa*, c. ap. (TA); Zuidhorn, 22 III 1908, *Van Giffen* (Gro).

Friesland: Marsum, 9 I 1927, 29 XII 1935, *Koopmans* (Koopm) Mirns, 2 XII 1928, *Koopmans* (Koopm); Sexbierum, 25 VIII 1942, *Maas G. 2176* (L); Sloten, 2 VI 1929, *Koopmans* (Koopm).

Drente: Beilen, 25 V 1943, *Wasscher* (L); Drouwen-Borger 7 V 1941, *Maas G. 1010* (L); Dwingelo, Westeinde, 31 VII 1941, *Maas G. 1451* (L); Eelde, Oosterbroek, 14 VIII 1855, 17 VIII 1858, *Van Hall*, c. ap. (NBV); Ees, 7 V 1941, *Maas G. 1018*, transition to f. *carneola* (L); Eext, 3 V 1941, *Maas G. 735* (L); 5 V 1941, *Maas G. 932* (L); Gieten, 8 V 1941, *Maas G. 1070* (L); Noordlaren, 5 V 1941, *Maas G. 920*, transition to f. *microphylla* (L); Norg-Een, 4 V 1941, *Maas G. 882*, transition to f. *carneola* (L); Paterswolde, *Van Hall*, c. ap. (NBV); Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld 7489* (L); Zuidlaren, 4 XI 1859, *Acker Stratingh* (Gro)

Overijsel: Dalfsen, III 1909, *Lako*, c. ap. (L, NBV); 1 VIII 1939, *Van Ooststroom 7445* (L); Diepenheim, 20 VII 1941, *Maas G. 1183* (L); 21 VII 1941, *Maas G. 1210* (L); Diepenheim-Markelo, 21 VII 1941, *Maas G. 1204* (L); Genne, Zijkolk, 10 V 1941, *Stafleu*, c. ap., transition to f. *carneola* (U); Hellendoorn, 26 VII 1941, *Maas G. 1284* (L); Kampen, *Bondam*, c. ap. (NBV); *Top* (L); IV 1889, *Top* (L); Markelo, 23 VII 1941, *Maas G. 1238, 1245* (L); Markelo-Laren, 23 VII 1941, *Maas G. 1265* (L); Vollenhove, 22 VII 1928, *Koopmans* (Koopm); Wijhe-Heino, VI 1905, *Lako* (L); IJselmuiden, Zandberg, IV 1889, *Top* (L); Zwolle, II 1906, *Lako* (NBV); XI 1908, *Lako* (L); I 1909, *Lako*, c. ap. (L, NBV); III 1909, V 1916, *Lako* (L); Zwolle, Katerveer, V 1889, *Top* (L); Zwolle, Spoolde, II 1906, *Lako* (L).

Gelderland: Bennekom, De Meent, 23 V 1943, *Maas G. 2474* (L); Doesburg, Dierensche dijk, 13 VI 1943, *Maas G. 2562*, transition to f. *incusa* (L); Doornspijk, 29 X 1941, *Van Soest 628* (VS); Doornspijk, De Haere, 26 IV 1942, *Maas G. 1870* (L); Doorwerth, *Buse & Buse-Koppiers* (NBV); Elburg, 15 VIII 1939, *Van Soest 119, 121* (VS); Epe, 30 IV 1939, *Groot & Van Soest 125*, transition to var. *glomerata* (VS); Gorsel, IV 1919 (U); Harderwijk, *Bondam* (L, NBV); Hees, VIII 1858, *Oudemans* (U); Hierden, Hulshorst, 24 X 1941, *Maas G. 1564* (L); Keppel, IX 1850, *Van den Bosch* (NBV); Nulde, 25 X 1941, *Maas G. 1605* (L); Nijkerk, I 1866, *Bondam*, transition to f. *incusa* (L); II 1866, *Top*, c. ap. (NBV); 2 IV 1866 (L); Nijkerk, Hoef, 1 III 1866, c. ap. (L); Nijmegen, *De Beyer*, c. ap. (NBV); II 1847, 1850, *Abeleven*, c. ap. (NBV); Nijmegen, Berg en Dal, 2 I 1870, *Van Hall*, c. ap. (NBV); Renkum, *Buse & Buse-Koppiers*, c. ap. (L, NBV); VII 1849, *Buse & Gildemeester-Buse*, c. ap. (NBV); Ubbergen, 3 X 1873, *Abeleven*, c. ap. (L); Velp, *Buse*, c. ap. (NBV); 1849, *Van den Bosch* (NBV); Wageningen, *Buse & Buse-Koppiers* (NBV); Warnsveld, 28 XII 1929, *Wassink 3361*, c. ap. (Wask); 28 XII 1940, *Wassink 3349* (Wask); Winterswijk, Bekkendelle, 14 IV 1941, *Stafleu* (U); Zaltbommel, 16 II 1941, *De Jong* (U); III 1941, *Stafleu*, transition to f. *incusa* c. ap. (U); Zutfen, VII 1840, *Buse & Gildemeester-Buse*, c. ap., transition to f. *incusa* (NBV).

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 696*, c. ap. (L); De Bilt, 19 I 1930, *Wassink 131*, c. ap. (Wask); Bilthoven, 18 VI 1933, *Nannenga 29*, partly transition to var. *glomerata* (Nga); Breukelen-Maarssen, 6 VIII 1943, *Maas G. 2704* (L); Bunnik, 25 VI 1933, *Nannenga 37* (Nga); Driebergen, 4 IX 1868, *Oudemans*, c. ap. (Gro, L, NBV); Grebbe, Grebbeberg, 23 III 1907, *Des Tombe*, c. ap. (L); Huis ter Heide, 23 VII 1859, *Van Hall*, c. ap. (NBV); Leersum, 26 X 1940, *Maas G. 45, 51, 54* (L); *Maas G. 60*, transition to f. *incusa* (L); 19 IV 1941, *Maas G. 692*, transition to f. *carneola* (L); Maartensdijk, 18 XII 1919, *Hart de Ruyter* (U); Portengen-Breukelen, 6 VII 1943, *Maas G. 2701* (L); Ter Aa, 12 VIII 1943, *Maas G. 2720* (L); Utrecht, VII 1830, *Van Hall*, c. ap. (NBV); 1841, *Van der Sande Lacoste* (L, NBV); 14 XI 1931, *Van Ooststroom 6185* (L); Vechten-Bunnik, *Van der Trappen* (L, NBV); Veldhuizen-De Meern, 23 II 1941, *Stafleu*, c. ap. (U); 4 IV 1942, *Stafleu* (U); De Vuursche, Lage Vuursche, 7 V 1939, *Nannenga 775* (Nga); Woudenberg, 9 IV 1944, *Agsteribbe*, c. ap. (L); Zeist, *Gevers Deynoot* (NBV); *Molkenboer*, c. ap. (NBV); Zeist-Baarn, 12 II 1920, *Hart de Ruyter* (U).

Noord-Holland: Aerdenhout, 28 VI 1942, *Maas G. 1970* (L); Amsterdam, Kalfjeslaan, XII 1848, *Van der Sande Lacoste* (NBV); Enkhuizen, 24 VIII 1942, *Maas G. 2161* (L); Haarlem, *Molkenboer*, c. ap. (NBV); *Splitgerber* (NBV); Haarlem, Haarlemmerhout, III 1873, *Hoek*, c. ap. (NBV); Hilversum, 6 III 1932, *Wassink 3389*, c. ap., transition to f. *incusa* (Wask); Naarden, VIII 1864, *Oudemans* (Gro); Oostwoud-Hauwert, 8 IV 1945, *Maas G. 3159* (L); Oudijk, 11 V 1945, *Maas G. 3221*, c. ap. (L); Schagen, 5 III 1941, *Schroevers* (L); Vogelenzang-De Zilk, 12 V 1947, *Maas G. 3684*, transition to f. *incusa*, c. ap. (L); Wognum, 10 V 1945, *Maas G. 3211* (L); Zandvoort, III 1863 (NBV).

Zuid-Holland: Ammerstol, 19 VIII 1942, *Maas G. 2132* (L); Dordrecht, II 1883, *Van den Broek* (NBV); 's Gravenhage, 10 I 1830, c. ap. (NBV); Hillegom, 16 III 1942, *Van Rossem 88* (L); Katwijk aan den Rijn, 3 III 1942, *Van Rossem 91* (L); Katwijk-Wassenaar, 21 XII 1912, *Ten Kate*, c. ap. (L); Leiden, I 1830, *Wttewaal*, c. ap. (NBV); 10 V 1939, *Groot & Van Soest 318* (VS); 8 X 1940, *Maas G. 25*, c. ap. (L); 10 V 1942, *Maas G. 1889*, transition to f. *microphylla* (L); Lisse, Keukenhof, 9 III 1942, *Van Rossem 98*, transition to f. *carneola* (L); Monster, 1851, unio NBV (NBV); Oegstgeest, 20 X 1940, *Maas G. 39* (L); 18 VI 1942, *Van Rossem 169*, c. ap. (L); Oud Ade, Vennemeer, 10 V 1942, *Maas G. 1903* (L); Rijnsaterwoude, 19 IV 1943, *Maas G. 2430* (L); Rijnsburg-Valkenburg, 4 III 1942, *Van Rossem 108*, transition to f. *incusa* (L); Sassenheim, XI 1829, *Altena* (NBV); Vianen, VIII 1830, *Van Hall*, c. ap. (NBV); Wassenaar, 15 V 1922, *Ten Kate*, c. ap. (L); 10 X 1940, *Maas G. 28* (L); Wassenaar, Meiendel, 13 X 1940, *Maas G. 34* (L); 31 X 1940, *Maas G. 98*, c. ap., transition to f. *incusa* (L); 5 VII 1941, *Stafleu* (U); 6 IX 1943, *Maas G. 1415*, transition to f. *incusa* (L); Wassenaar, Waalsdorp, 9 I 1939, *Groot 316, 317* (VS).

Zeeland: Walcheren, Arnemuiden, Sloedam, 1 V 1941, *Brakman* (L); Walcheren, Middelburg, XII 1912, *Lako* (L); Walcheren, Nieuw en St. Joosland, IV 1877, *Lako* (L); 25 III 1941, 13 III 1942, 17 III 1942, *Brakman* (L); Zuid Beveland, VII 1842, *Van den Bosch*, c. ap. (NBV); Zuid Beveland, Goes, 12 XI 1943, *Maas G. 2951* (L); Zuid Beveland, 's Heerenhoek, 2 V 1941, *Brakman* (L).

Noord-Brabant: Heeze, VII 1857, *Oudemans* (Gro); 's Hertogenbosch, 6 II 1904, *Wakker* (L); Nuenen, V 1924, *Smelt*, c. ap. (VD Wijk); Oisterwijk, Logtsche heide, 23 VII 1943, *Maas G. 2623* (L); Tilburg, 4 IV 1939, *Nannenga 767* (Nga).

Limburg: Kamerig, 7 VII 1942, *Van Rossem 211* (L); *Van Rossem 234*, transition to var. *glomerata* (L); VII 1943, *Meeuse* (L); Maastricht, *Franquinet* (L, Maastr); *Ploem*, transition to f. *incusa* (L); Terpoorten, 12 VII 1942, *Maas G. 2005*, transition to var. *glomerata* (L); Terziet, 16 VII 1942, *Maas G. 2037* (L).

var. **acetabulum** f. **carneola** Parr. in Act. Soc. Linn. Bordeaux, ser. 7, vol. 1, 1906, p. 144; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 79 et vol. 10, 1940, p. 504 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 113.

Upper side of the thallus pale olive. Apothecial disc flesh-coloured.

Ecology and frequency. In shaded places, rare, usually appearing in a stage approaching f. *eu-acetabulum.*

Noord-Holland: Bergen, 16 XI 1940, *Maas G. 194* (L).
Zuid-Holland: Noordwijkerhout, De Zilk, II 1941, *Dijk,* c. ap. (L); Wassenaar, Meiendel, 5 X 1940, *Maas G. 16,* c. ap. (L).

var. **acetabulum** f. **incusa** (Wallr.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 115; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 504 (ubi lit.) — *Parmelia corrugata* l. *incusum* Wallr., Fl. Cryptog. German., vol. 1, 1831, p. 504.

Upper surface thickly albo-pruinose.

Remarks. Most of the specimens are transitional stages rather than typical *incusa.*

Drente: Assen, 2 V 1941, *Maas G. 720,* c. ap., partly (L).
Overijsel: Vollenhove, VI 1916, *Lako,* c. ap., partly (L); Zwolle, Zuthem, III 1903, *Lako,* c. ap., partly (L).
Gelderland: Velp, 1849, *Van den Bosch,* c. ap., partly (L, NBV); Zutfen, VII 1840, *Buse & Gildemeester-Buse,* c. ap. (NBV).
Noord-Holland: Schagen, 5 III 1941, *Schroevers,* partly (L).
Zuid-Holland: Noordwijkerhout, 22 VIII 1927, *Ten Kate* (L).

var. **acetabulum** f. **microphylla** Bouly de Lesd., Rech. Lich. Dunkerque, Suppl. 1, 1914, p. 71 (non vidi) et in Bull. Soc. Bot. France, vol. 68, 1921, p. 16; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 79 et vol. 10, 1940, p. 504; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 115.

Thallus in the centre or all over the upper surface more or less covered with upright, rather thick folioles.

Remarks. The description given by Bouly de Lesdain in Bull. Soc. Bot. France runs as follows: "Thalle couvert au centre de petites folioles dressées, imbriquées....". I should like to keep the description more vague, since in several forms the folioles are not imbricate, whereas they may be restricted to the centre as well as dispersed all over the surface, laminal as well as marginal.

Drente: Eext, 3 V 1941, *Maas G. 734a* (L); Hoogeveen, 12 XII 1940, *Maas G. 250* (L).
Overijsel: IJsselmuiden, Oosterholt, IV 1889, *Top,* c. ap. (L); Zwolle, *Kros,* c. ap. (NBV); Zwolle, Voorst, I 1909, *Lako,* c. ap. (L).
Utrecht: Doorn, 20 IV 1941, *Maas G. 706,* partly (L).
Noord-Holland: Oudijk, 11 V 1945, *Maas G. 3220,* transition to f. *incusa* (L).
Zuid-Holland: Rijpwetering, 10 V 1942, *Maas G. 1910* (L).
Zeeland: Zuid Beveland, Nieuwdorp, 30 XI 1940, *Brakman* (L); Zuid Beveland, Ovezande, Noorddijk, V 1840, *Van den Bosch* (NBV).

var. **glomerata** Hillm. in Verh. Bot. Ver. Prov. Brandenburg, vol. 65, 1923, p. 66 et in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 116; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 553 et vol. 10, 1940, p. 505.

Upper surface of the thallus, except for a smooth peripherical zone, completely and strongly wrinkled or covered with warts and papillae. Wrinkles occasionally driven up into cushion-shaped folds.

Ecology and frequency. In Holland found in exposed places, rare.

Remarks. In f. *eu-acetabulum* old thalli frequently tend to grow wrinkled in the centre. If, in addition, the pycnidia become strongly prominent and verrucose, such specimens might easily be mistaken for var. *glomerata.*

Gelderland: Doornspijk, 25 IV 1942, *Maas G. 1822,* c. ap. (L).

Utrecht: Portengen-Breukelen, 6 VIII 1943, *Maas G. 2701a* (L); Utrecht, 10 V 1930, *Van Ooststroom 3152* (L).

Limburg: Kamerig, 7 VII 1942, *Van Rossem 191* (L); 13 VII 1942, *Maas G. 2018* (L).

7. **Parmelia prolixa** (Ach.) Malbr. in Bull. Soc. Amis Sci. Natur. Rouen, vol. 3, 1867, p. 473; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 103; vol. 8, 1932, p. 564 et vol. 10, 1940, p. 530 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 125 — *Parmelia olivacea* var. *prolixa* Ach., Meth. Lich., 1803, p. 214.

Macroscopical description. Thallus foliaceous, up to 5 cm in diam., growing in rosettes or wide-spreading, closely appressed to loosely adhering or almost free, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, rather rigid, 1 cm long or more, 1—1.5 mm broad, more or less flat or wavy, contiguous, overlapping at the tips or widely separate, irregularly or pinnately incised and branched. Margins flat, entire or slightly crenate. Tips broadened or not, free from the substratum to somewhat raised, rounded or lobate. Upper surface of the lobes olive-brown, shiny and reticulately dented at the tips, somewhat darker, dull and frequently wrinkled towards the centre, with occasional cortical cracks, without isidia or soredia. Lower side black and dull except for the tips which are brown and shiny, rather densely to sparingly rhizinose, rhizinae black, simple, gradually passing into warts which reach as far as the tips of the lobes. *Microscopical description.* Upper cortex colourless, with a brown exterior zone, paraplectenchymatous, 9—25 (—40) μ, covered with an amorphous cuticle. Gonidia bright green, spherical, 8—12 μ, arranged in a layer of 30—45 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 60—250 μ, consisting of pachydermatous hyphae. Lower cortex black-brown, paraplectenchymatous, 12—18 μ. *Apothecia* numerous if present, laminal, sessile, at first cup-shaped, later saucer-shaped, eventually of irregular form and torn, up to 3 mm in diam. Amphithecium concolorous with the upper side of the thallus, somewhat shiny, smooth or uneven. Margin thick, entire, later sometimes crenate or more or less receding. Disc of the same colour as the thallus or darker, slightly shiny or dull, without pruina, smooth, later on wavy. Epithecium yellow-brown, hymenium colourless, hypothecium yellowish, with gonidia underneath. Hymenium about 60 μ. Asci clavate, 9—12 × 30—50 μ, 8-spored. Spores colourless, ellipsoidal, faintly curved, rather thick-walled, 4—6 × 8—10 μ. Paraphyses simple, septate, conglutinate. *Pycnidia* laminal, visible as black pits, spherical or irregular, up to 180 μ in diam. Perifulcrium colourless, ostiolum dark brown. Pycnoconidia colourless, bifusiform, with attenuated middle and apices, straight, ± 1 × 4—6 μ.

Chemical constituents and reactions. Upper cortex K —, C + blue-grey, sometimes fading into yellowish, KC —, N + blue, then turning grey, Pd —. Medulla K —, C — or + red, KC — or + reddish, Pd —. According to Bachmann's investigations (in Jahrb. wiss. Bot., vol. 21, 1889, p. 39), the colour of the upper cortex is due to glomellifera brown, a compound of unknown chemical composition.

As stated by Zopf (Flechtenstoffe, 1907, p. 138, 297, 418), var. *locarnensis* contains gyrophoric acid ($C_{16}H_{14}O_7$) and imbricaric acid. Investigations by Asahina, Yanagita and Omaki (in Ber. Deutsch. Chem. Ges., vol. 66 B, 1933, p. 943—947) yielded the formula $C_{24}H_{20}O_{10}$ for gyrophoric acid. This acid accounts for the red colouration of the medulla when treated with C.

Distribution. *Parmelia prolixa* is presumably widely distributed in Europe, though I did not find any records from Latvia, Luxemburg and the U. S. S. R.

Remarks. This species varies into two main directions, a physiological and a morphological one. The former, which finds expression in a difference in chemical reactions, is represented by such varieties as var. *delisei* and var. *locarnensis*, the latter by var. *perrugata* and var. *pokornyi*. Now, perhaps except var. *perrugata*, these varieties are mainly or exclusively limited to South Europe, small wonder therefore that they do not occur in Holland. Only var. *delisei* has been found twice in this country.

Key to the varieties.

1a. Upper surface of the thallus olive-brown. Medulla indifferent to KC var. **prolixa** (Ach.) Maas G.
1b. Upper surface paler olive. Medulla KC + reddish var. **delisei** (Duby) Nyl.

var. **prolixa** (Ach.) Maas G. nov. comb. — *Parmelia olivacea* var. *prolixa* Ach., Meth. Lich., 1803, p. 214 — *Parmelia prolixa* var. *typica* Lynge in Bot. Tidsskr., vol. 38, 1923, p. 74.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 23, fig. 5; Rosend. in Nov. Act., Abh. Kais. Leopold.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 10.

Thallus growing in rosettes or wide-spreading, closely appressed. Lobes contiguous or overlapping. Upper surface of the lobes olive-brown. Medulla unaltered by KC.

Ecology and frequency. Saxicolous, on siliceous boulders, rare.

Remarks. I consider this variety identical with the type of *Parmelia olivacea* var. *prolixa*. Var. *prolixa* would seem to be well characterised by the lack of soredia and isidia. Yet, there are specimens of *Parmelia isidiotyla* almost destitute of isidial growth to the extent of raising trouble in deciding their exact identity (see there).

Groningen: Bierum, Nansum, 14 VIII 1856 (Gro); Uitwierde, 14 VIII 1856, *Acker Stratingh*, c. ap. (Gro).

Drente: Borger, VIII 1889, *Top* (L); Exloo, 17 VII 1939, *Van Ooststroom & Zaneveld* (L).

var. **delisei** (Duby) Nyl. in Not. Sällsk. F. Fl. Fenn. Förh., N. S., vol. 2, 1861, p. 102; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 127; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 530 — *Parmelia olivacea* var. *delisei* Duby in De Cand. et Duby, Bot. Gall., ed. 2, vol. 2, 1830, p. 602 — *Parmelia delisei* Nyl. in Flora, vol. 55, 1872, p. 426; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 81 et vol. 8, 1932, p. 557 (ubi lit. et synon.).

Upper side of the thallus somewhat paler brown than in var. *prolixa*. Medulla KC + reddish, fading.

Gelderland: Nijkerk, 28 XII 1920, *Keyzer & Florschütz* (U); Putten, 26 III 1921, *Ten Kate* (L).

8. **Parmelia aspera** Mass., Mem. Lichenogr., 1853, p. 53 — *Parmelia olivacea* var. *aspidota* Ach., Meth. Lich., 1803, p. 214 — *Imbricaria aspera* (Mass.) Körb., Syst. Lich. German., 1855, p. 78; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 19 — *Parmelia aspidota* (Ach.) Pötsch in Pötsch et Schiederm., Syst. Aufzähl. samenl. Pfl., 1872, p. 253 (non vidi); A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 79; vol. 8, 1932, p. 553 et vol. 10, 1940, p. 506 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 135.

Macroscopical description. Thallus foliaceous, up to 8 or 10 cm in diam., growing in rosettes, closely appressed, attached to the substratum by means of rhizinae, incised. Lobes dorsiventrally flattened, rigid, up to about 2 cm long and 6 mm broad, flat at the tips, becoming wavy or folded in the centre, contiguous or overlapping at the tips, irregularly incised. Margins flat or somewhat revolute, entire or somewhat crenate. Tips broadened, rounded or broadly lobate, either provided with rhizinae projecting sideways or not. Upper side of the lobes olive-brown to chestnut, entirely dull or slightly shiny at the tips, epruinose or covered with a bluish pruina, radiately or irregularly wrinkled towards the centre, without soredia, but more or less densely dotted with peculiar, indented to perforated, dark brown warts which are supposed to serve as breathing pores (Hillmann, l. c. p. 138). Warts with smooth or crenulate apices. Lower side of the lobes brown to pale brown and shiny at the tips, black and dull in the centre, densely rhizinose up to the very tips or with a narrow bare zone. Rhizinae dark or pale, sometimes with a terminal brush. *Microscopical description.* Upper cortex colourless, with a broad brown exterior zone, paraplectenchymatous, covered with an amorphous cuticle, 12—25 μ. Gonidia bright green, spherical, 9—14 μ, arranged in a layer of 20—40 μ. Medulla colourless, white in reflected light, more or less densely plectenchymatous, growing more dense or even scleroplectenchymatous near the lower cortex, 40—120 μ, consisting of pachydermatous hyphae. Lower cortex brown, indistinctly paraplectenchymatous, 9—12 (—15) μ. *Apothecia* numerous and often crowded in the centre of the thallus, laminal, sessile, saucer-shaped, finally wavy and revolute, up to 8 mm in diam. Amphithecium pale or dark brown, shiny, smooth or uneven or with an occasional wart. Margin dotted with warts and thus appearing indented, persistent or almost receding. Disc concolorous with the thallus or dark chestnut, somewhat shiny, especially when young, smooth, later on uneven. Epithecium yellow-brown, hymenium colourless, hypothecium yellowish, with a gonidial layer underneath. Hymenium 70—100 μ. Asci cylindrical or clavate, 6—15 × 45—90 μ, octosporous. Spores colourless, ellipsoidal, somewhat thick-walled, 6—7 × 10—14 μ. Paraphyses little branched, septate, conglutinate, with slightly incrassate apex. *Pycnides* inconspicuous, though perhaps not uncommon, visible as scattered dark dots in between the warts, spherical or pyriform, about 150 μ in diam. Perifulcrium brown, ostiolum dark brown. Pycnoconidia colourless, cylindrical, straight, somewhat curved or bifusiform, 1 × 5—9 μ.

Chemical constituents and reactions. Upper cortex K —, C —, KC —, Pd —, N + red-brown. Medulla unaltered by these chemicals. The cortical colour is due to parmelia brown, a compound not further analysed (see Bachmann in Jahrb. wiss. Bot., vol. 21, 1889, p. 39).

Distribution: The species is distributed all over Europe.

Remarks. Degelius (in Svensk Bot. Tidskr., vol. 36, 1942, p. 40, note) pointed out that the epithet *aspera* has priority over the younger combination *aspidota*.

Parmelia aspera is a very characteristic species among the *Melaenoparmeliae* in that the numerous perforated warts render a rough and raspy appearance to its upper surface.

Though some time *P. aspera* has certainly been considered to be of varietal disposition, it is long since generally accepted as a species of its own. It is, therefore, striking to find Berry (in Ann. Missouri Bot. Garden., vol. 28, 1941, p. 63) treating *P. aspera* as a variety of *P. olivacea* again. This author argues that "Thalloid characters of such a nature (i. e. "granules and coralloid branchlets on the upper surface of the thallus etc.") do not merit the rank of species". To this view I may oppose some more features in favour of *P. aspera* as a species. First, the pycnoconidia are on the whole longer in *P. aspera* than in *P. olivacea*; secondly, the medullary reaction upon Pd is negative in the former, yellow and then turning orange in the latter; thirdly, whereas the upper surface is dull or nearly so in *aspera*, it is strongly shiny in *olivacea*. These properties combined with the remarkable warts of *P. aspera* perfectly justify this species being separated from *P. olivacea*.

f. **aspidota** (Ach.) Maas G. nov. comb. — *Parmelia olivacea* var. *aspidota* Ach., Meth. Lich., 1803, p. 214.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 24, fig. 4; Rosend. in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 3.

Lobes epruinose. Warts, if numerous, not crowded in the centre of the thallus, with smooth apices. Pycnoconidia cylindrical, straight or somewhat curved, 7—9 μ long.

Ecology and frequency. On deciduous trees, upon wood. No recent finds are known any more.

Remarks. I consider this form to correspond with the type of *Parmelia aspera*.

Groningen: Groningen, XII 1854, *Acker Stratingh*, c. ap. (Gro); VIII 1855, *Acker Stratingh*, c. ap. (NBV); Groningen, Sterrebosch, 24 III 1848, *Van Hall* (NBV); Haren, Harendermolen, VIII 1855, *Acker Stratingh*, c. ap. (Gro, NBV).

Gelderland: Doorwerth, *Buse & Buse-Koppiers*, c. ap. (L, NBV); Elburg, VII 1864, *Van der Sande Lacoste*, c. ap. (NBV); Harderwijk, *Bondam*, c. ap. (L); Leuvenum-Speulde, 28 IV 1919, *Ten Kate* (L).

Utrecht: Leersum, Darthuizen, *Van Hall*, c. ap. (NBV).

Noord-Brabant: 's Hertogenbosch, 6 II 1904, *Wakker*, c. ap. (L); 's Hertogenbosch-Helvoort, 25 X 1905, *Wakker*, preserved under P. quercina (L).

9. **Parmelia laciniatula** (Flag.) A. Zahlbr. in Ann. K. K. naturhist. Hofmus. Wien, vol. 30, 1916, p. 216; Cat. Lich. Univ., vol. 6, 1929, p. 94; vol. 8, 1932, p. 561 et vol. 10, 1940, p. 523 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 142 —

Parmelia exasperatula var. *laciniatula* Flag. apud Oliv. in Rev. de Bot., vol. 12, 1894, p. 69.

Iconography: this paper fig. 14.

Macroscopical description. Thallus foliaceous, small, 1—2 cm in diam., growing in rosettes when young, later more wide-spreading, closely appressed, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, thin, about 5 or 7 mm long, and 1—2 mm broad, flat, wavy or ascending, somewhat overlapping at the tips, more or less imbricate in the centre of the thallus, irregularly or pinnately incised. Margins flat or ascending, rarely entire, usually coarsely or minutely crenate, becoming increasingly laciniate towards the centre of the thallus. Tips broadened, broadly lobate or crenate. Upper side of the lobes paler or darker olive, shiny, smooth or somewhat uneven, esorediate, but with scattered isidia which, in parts of the thallus, are not always equally

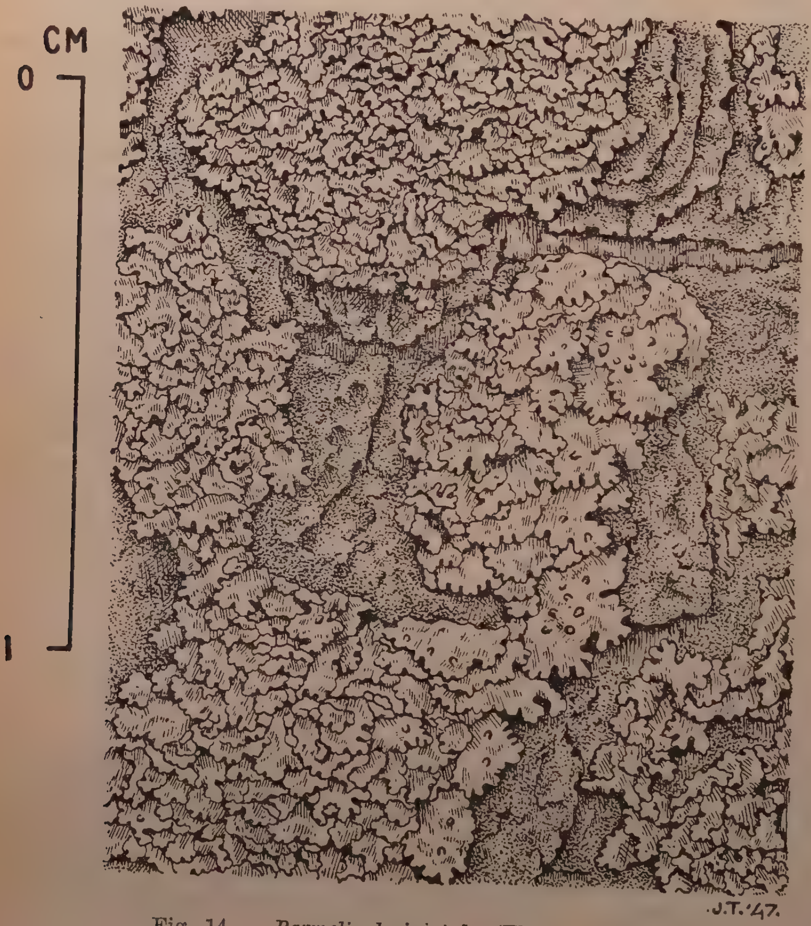


Fig. 14 — *Parmelia laciniatula* (Flag.) A. Zahlbr.

conspicuous. Isidia at the tips of the lobes small, wart-like, towards the middle of the thallus soon developing into simple, emarginate or crenate folioles. Marginal laciniae also growing out, and developing into 0.2—1 mm long, crenate or branched folioles which, finally, completely and imbricately cover the whole of the thallus. Lower side of the lobes pale olive, still paler to almost whitish at the tips, shiny, smooth or irregularly wrinkled, with scattered, pale or dark, simple rhizinae. *Microscopical description.* Upper cortex pale brown, paraplectenchymatous, 1-layered, 9—12 μ. Gonidia bright green, spherical, 8—12 μ, arranged in a dense layer of 20—30 μ. Medulla colourless, white in reflected light, more or less densely plectenchymatous, 30—45 μ, consisting of pachydermatous hyphae. Lower cortex colourless, paraplectenchymatous, 6—9 (— 10) μ. *Apothecia* and *pycnidia* not observed.

Chemical reactions. Upper cortex N + red, for the rest indifferent to the usual chemicals, as is the medulla.

Ecology and frequency. On deciduous trees along roads, rare, though perhaps overlooked. Apparently always in company of other brown *Parmeliae.*

Distribution. The distribution of this species in Europe is insufficiently known. It has been recorded from Austria, Czechoslovakia, Denmark, Germany, Sweden, Switzerland, and Yugoslavia, reaching the north boundary of its area in southern Sweden (see papers by Almborn in Bot. Notis., 1935, p. 464—471; Bot. Notis, 1939, p. 773—775; and by Degelius in Bot. Notis., 1933, p. 509; Bot. Notis., 1939, p. 393—394). *P. laciniatula* is considered to be a Central European species.

Remarks. Its smallness as well as the crowded and imbricate lobules covering more or less the whole of the thallus are features sufficiently conspicuous to distinguish this species in the field from all other brown *Parmeliae.* Yet, some special attention is needed in distinguishing *P. laciniatula* from *P. exasperatula* f. *sublaciniatula* (see there).

Drente: Eext, 3 V 1941, *Maas G. 734b* (L).

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 686c* (L); Baarn, Groeneveld, 7 II 1943, *Maas G. 2271b* (L); Maarssen-Breukelen, 11 IX 1943, *Maas G. 2800* (L).

10. Parmelia exasperatula Nyl. in Flora, vol. 66, 1873, p. 299; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 85; vol. 8, 1932, p. 558 et vol. 10, 1940, p. 517 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 143.

Macroscopical description. Thallus foliaceous, 2—4 cm in diam., growing in rosettes, wide-spreading with age, closely appressed to somewhat loosely adhering, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, very thin, flexible, about 1 cm long, 2—3 mm broad, rarely flat, usually more or less wavy or folded, overlapping at the tips, irregularly incised. Margins flat or ascending and undulate, coarsely crenate or lobate. Tips broadened up to 4 or 5 mm, raised to strongly ascendant, crenate, lobate or incised. Upper side of the lobes paler or darker olive, more or less shiny, especially strongly shiny at the tips, smooth, uneven or slightly wrinkled, without soredia, but more or less densely isidiate. Isidia laminal, varying from hardly prominent warts to grown-out, leaf-like excrescences, inflated, concolorous with the thallus, shiny. Sometimes isidia also occur along the margins or even at the tips of the lobes. Lower side of the lobes dirty white, dull, towards the tips of the lobes more brown to greyish brown and shiny, irregularly or reticulately dented and veined, sparingly rhizinose. Rhizinae pale, simple or with a brush-like ending. *Microscopical description.* Upper cortex brownish, paraplectenchymatous, 1-layered, 3—6 (—9) μ. Gonidia bright green, spherical, 8—16 (—18) μ, arranged in a layer of 30—60 μ. Medulla colourless, white in reflected light, more or less densely plectenchymatous, 60—120 μ, consisting of mesodermatous to leptodermatous hyphae. Lower cortex colourless, paraplectenchymatous, 9—15 μ. *Apothecia* and *pycnidia* not observed.

Chemical reactions. Upper cortex as well as medulla unaltered by the usual reagents.

Ecology and frequency. On deciduous road-side trees, wood, roof-tiles, on boulders. Apparently nitrophilous, occurring throughout the country, though not equally common everywhere.

Distribution. No exact data on the distribution of this species in Europe can be given; it seems to be missing in several countries. Tavares, for instance, in his treatise on the Portuguese *Parmeliaceae* (Portugal. Act. Biol., vol. 1 B, 1945) does not report *P. exasperatula* for his country.

Remarks.. *Parmelia exasperatula* shows little variability, the few forms described bearing on the size of the isidia. This brown *Parmelia* is well characterised by its very thin thallus, the whitish lower surface and its shiny and swollen isidia. When broken off, these isidia appear to be hollow on account of their thin medullary tissue. Another very conspicuous feature is the change of colour from olive into bright green on moistening the thallus. As regards the difference from *P. elegantula,* see there.

Key to the forms.

1a. Isidia in part considerably broadened, and developed into folioles f. **sublaciniatula** Erichs.
1b. Isidia not broadened into folioles 2
  2a. Isidia of normal length, up to 1 mm long f. **exasperatula** (Blombg. et Forss.) Maas G.
  2b. Isidia very short, hardly prominent . . . f. **subrasa** (Harm.) Maas G.

f. **exasperatula** (Blombg. et Forss.) Maas G. nov. comb. — *Parmelia olivacea* var. *prolixa* f. *exasperatula* Blombg. et Forss., Enum. Pl. Scand., 1880, p. 65 (non vidi).

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 24, fig. 6; Rosend. in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 1; this paper fig. 15.

Isidia at the tips of the lobes very small and minute, wart-like, towards the centre of the thallus soon growing out into inflated, clavate or spatulate, frequently emarginate excrescences (isidia claviformia), reaching a length of about 1 mm.

Remarks. I consider this form to agree with the type of *Parmelia exasperatula.* Looking up the oldest subdivisional epithet conformable with this type, one might arrive at *Imbricaria olivacea* f. *papulosa* Anzi. As pointed out by Zahlbruckner (in Ann. K. K. naturhist. Hofmus. Wien, vol. 27, 1913, p. 272), however, this name is invalid, since it was labeled on an exsiccatum without a description.

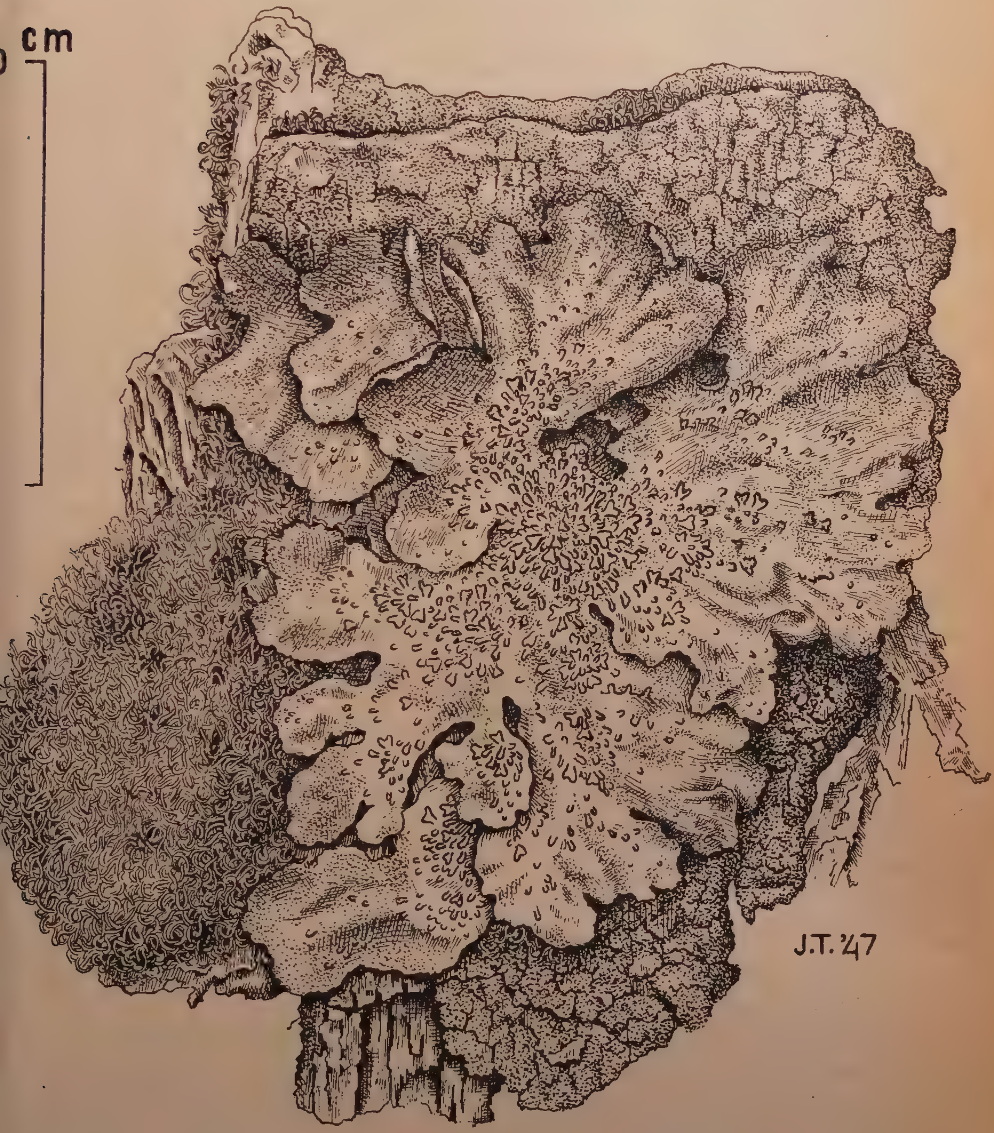


Fig. 15 — *Parmelia exasperatula* Nyl. f. *exasperatula* (Blombg. et Forss.) Maas G., young specimen.

Groningen: Beerta, Nieuw Beerta, 22 VIII 1933, *Nannenga 274, 278a* (Nga); Beerta, Beersterhooge, 11 VII 1942, *Nannenga 1269* (Nga).

Drente: Bronneger, 6 V 1941, *Maas G. 974* (L); Dwingelo, Westeinde, 31 VII 1941, *Maas G. 1443* (L); Eelde, Eelderwolde, 11 VIII 1836, *Van Hall* (NBV); Eelde, Oosterbroek, 13 VIII 1855, *Van Hall* (NBV); Eext, 3 V 1941, *Maas G. 733* (L); 5 V 1941, *Maas G. 930* (L); Midlaren, 5 V 1941, *Maas G. 916* (L); Rhee, 4 V 1941, *Maas G. 789* (L).

Overijsel: Bathmen, Zuidloo, 1 IX 1850, *Abeleven* (NBV); Diepenheim, 20 VII 1941, *Maas G. 1182a* (L); Geesteren, 20 VII 1941, *Maas G. 1171* (L); Kampen, *Bondam* (NBV); Markelo, 23 VII 1941, *Maas G. 1258* (L); *Maas G. 1237*, transition to f. *sublaciniatula* (L); Zwolle, III 1909, *Lako* (L).

Gelderland: Doorwerth, *Buse & Buse-Koppiers* (NBV); Nijmegen, I 1851, *Abeleven* (NBV); Velp, V 1849, *Van den Bosch* (NBV); Voorthuizen, 30 XII 1941, *Stafleu* (U); 28 XII 1941, *Stafleu*, transition to f. *subrasa* (U); Warnsveld, 19 VII 1941, *Maas G. 1136*, transition to f. *sublaciniatula* (L).

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 686* (L); Baarn-Zeist, 1920, *Hart de Ruyter* (U); De Bilt, III 1841, *Van der Sande Lacoste* (NBV); 1 IV 1942, *Stafleu*, transition to f. *sublaciniatula* (U); Leersum, 19 IV 1941, *Maas G. 678* (L); Maarssen-Breukelen, 11 IX 1943, *Maas G. 2799* (L); Odijk, 10 VI 1942, *Maas G. 1936* (L); Veldhuizen-De Meern, 23 II 1941, 4 IV 1942, *Stafleu* (U).

Noord-Holland: Alkmaar-Heiloo, 16 IX 1943, *Barkman 593* (L); Oostwoud-Hauwert, 8 IV 1945, *Maas G. 3153* (L); Oostwoud-Midwoud, 26 IX 1943, *Barkman 613* (L); Oudijk, 11 V 1945, *Maas G. 3223* (L).

Zuid-Holland: Lisse, Keukenhof, 30 VII 1942, *Van Rossem* (L); Oud Ade, 21 VIII 1943, *Maas G. 2742* (L); Rijpwetering, 10 V 1942, *Maas G. 1909* (L); Stompwijk, 7 III 1943, *Maas G. 2291* (L); Zoeterwoude, 20 XII 1940, *Maas G. 361*, transition to f. *subrasa* (L).

Zeeland: Walcheren, Arnemuiden, Sloedam, 1 V 1941, *Brakman* (L).

Noord-Brabant: Breda, 1812, unio NBV (NBV); Heeswijk, 11 IX 1934, *Nannenga 500* (Nga); Westerhoven, 24 VII 1941, *Maas G. 2096* (L).

Limburg: Terpoorten, 12 VII 1942, *Maas G. 2009* (L); Terziet, Bovenste bosch, 16 VII 1942, *Maas G. 2033* (L).

f. **sublaciniatula** Erichs. in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 11; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 558 et vol. 10, 1940, p. 517; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 145.

Some of the isidia strongly broadened, and developed into shiny folioles with an emarginate or crenate top.

Ecology and frequency. Occurs along with f. *exasperatula*, but seems to be still more confined to exposed places.

Remarks. This form shows some resemblance to *P. laciniatula*, but in that species the margins are beset with crenate and, frequently, imbricate laciniae, whereas isidia only occur near the tips of the lobes, not in the centre of the thallus. Moreover, in *laciniatula* the lower cortex is thinner than the upper one, whereas the reverse is the case in f. *sublaciniatula*.

Groningen: Ekamp, 28 VII 1941, *Nannenga 1198* (Nga).

Drente: Assen, 2 V 1941, *Maas G. 722a* (L); Eext, 3 V 1941, *Maas G. 741* (L); Frederiksoord, 1 XI 1942, *Van Rossem 515* (L); Rhee, 4 V 1941, *Maas G. 789a* (L); Ubbena, 4 V 1941, *Maas G. 803* (L).

Gelderland: Bennekom-Veenendaal, 23 V 1943, *Maas G. 2466* (L).

f. **subrasa** (Harm.) Maas G. nov. comb. — *Parmelia exasperatula* var. *subrasa* Harm., Lich. France, vol. 4, 1909, p. 545; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 87 et vol. 10, 1940, p. 517; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 145.

Isidia very short, hardly prominent.

Remarks. Genuine f. *subrasa* has not yet been met with in Holland. The specimens found must be considered intermediate stages.

11. **Parmelia elegantula** (A. Zahlbr.) Szat. in Mag. Bot. Lapok, vol. 28, (1929) 1930, p. 77; Hillm. in Rabenh., Kryptog.-Fl. Deutschl.,

ed. 2, vol. 9, pars 5/3, 1936, p. 147; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 516 (ubi lit.) — *Parmelia aspidota* var. *elegantula* A. Zahlbr. in Verh. Ver. Heil- u. Naturk. Pressburg, vol. 8, 1894, p. 39 — *Parmelia exasperatula* var. *elegantula* A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 86 et vol. 8, 1932, p. 558 (ubi lit. et synon.).

Macroscopical description. Thallus foliaceous, 2—3 or 4 cm in diam., growing in rosettes, more wide-spreading with age, closely appressed, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, flexible, rather thin, about 0.5 cm long, 1—2 mm broad, flat or wavy, frequently more folded in the centre of the thallus, contiguous or overlapping at the tips, irregularly incised. Margins flat or wavy or somewhat ascending, entire or irregularly crenate. Tips broadened, fan-shaped, up to 3 or 4 mm broad, crenate, broadly lobate or incised. Upper side of the lobes paler or darker olive to brown (leathery yellow specimens occasionally found may be pathological due to damage by frost), entirely dull or shiny at the tips of the lobes, smooth, uneven or slightly dented, esorediate, without cortical cracks, isidiate. Isidia brownish, nearly always darker than the thallus, dull or sometimes shiny, minute, wart-like and scattered at the tips of the lobes, much longer and much more crowded in the centre, varying from 30 to 100 μ in breadth and up to 1.5 mm long, simple, furcate or richly branched, not infrequently so densely packed as to form a continuous or areolate cushion; incidentally this isidiose cushion covers the whole of the thallus except for a few lobes at the outskirts. Lower side of the lobes pale brown, somewhat darker at the tips, shiny, smooth, faintly wrinkled or veined, with scattered, pale brown, short, simple rhizinae. *Microscopical description.* Upper cortex brownish, paraplectenchymatous, 1-layered, 6—9 μ. Gonidia bright green, spherical, 9—15 μ, arranged in a continuous layer of 20—45 μ. Medulla colourless, withish in reflected light, thinly plectenchymatous, becoming somewhat more densely plectenchymatous towards the lower cortex, 30—60 μ, consisting of leptodermatous hyphae. Lower cortex brownish, as dark as or paler than the upper cortex to almost colourless, paraplectenchymatous, 1-layered, 6—15 μ. *Apothecia* and *pycnidia* not observed.

Chemical constituents and reactions. Upper cortex N + red-brown, otherwise indifferent to the usual reagents. Medulla C — or + red, otherwise indifferent. The reaction upon N indicates the presence of parmelia brown.

Ecology and frequency. On deciduous trees along roads, at the outskirts of woods, not common.

Distribution. Whereas it is as yet hardly possible to give the exact distribution of *Parmelia exasperatula* in Europe, this is still less so regarding *P. elegantula.* No doubt this species will some time be found in Spain, since it is known from Portugal, France and Italy, and also in Belgium, on account of its occurrence in the Netherlands, Germany and Luxemburg (where I found it in July 1947). Likewise, *P. elegantula* may be expected to occur throughout the Balkan peninsula, since it has been found in Czechoslovakia, Hungary and Greece. Farther to the north, however, the species seems to become rarer; it has been recorded from Denmark, but it is rare in Sweden, and no records at all are known from Norway, Finland, the Baltic republics, Poland and the U. S. S. R.

Key to the varieties.

1a. Medulla indifferent to the usual reagents var. **elegantula** (A. Zahlbr.) Maas G.
1b. Medulla C + red . . . . var. **isidioidea** (Oliv.) Hillm.

var. **elegantula** (A. Zahlbr.) Maas G. nov. comb. — *Parmelia aspidota* var. *elegantula* A. Zahlbr. in Verh. Ver. Heil- u. Naturk. Pressburg, vol. 8, 1894, p. 39.

Medulla indifferent to the usual reagents.

Remarks. I consider this variety to correspond with the type of *Parmelia aspidota* var. *elegantula.*

It is as much interesting as it is curious to learn the troubles Lettau apparently encountered in distinguishing specifically between *P. laciniatula* and *P. elegantula* (in Hedwigia, vol. 61, 1919, p. 156—158). Erichsen who was also engaged in this question (in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 13—14) clearly opposed the differences between both species and I may add some more here. In *P. laciniatula,* the medulla consists of pachydermatous hyphae, and the lower cortex hardly reaches a thickness of 10 μ. In *P. elegantula,* on the contrary, the medulla is composed of leptodermatous hyphae, whereas the lower cortex may reach as much as 15 μ.

Erichsen states the difference between the lower sides of both species as follows: whitish in *laciniatula,* pale brown in *elegantula* (though he at once observes it does not always come true!). Now, in the specimens examined I found that in *laciniatula* the lower surface is pale olive turning paler to almost whitish near the tips of the lobes, whereas in *elegantula* the lower side is pale brown, frequently with a ruddy hue, turning darker (olive) towards the tips.

More serious difficulties may arise in distinguishing between *P. elegantula* var. *elegantula* on the one side, and *P. subaurifera* f. *fuliginoides, P. fuliginosa* var. *fuliginosa* and var. *laetevirens* on the other. An unfailing distinguishing feature is the negative reaction of the medulla upon C in *elegantula.* From f. *fuliginoides* it may be told by its lack of soredia, and by the occurrence of simple warts up to the tips of the lobes. From var. *fuliginosa* and var. *laetevirens* it may be distinguished by its much less shiny lobes, by the warts occurring up to the tips of the lobes, by its lower cortex which may reach a greater thickness, and by the medullary tissue which is not so brightly white on account of its being more thinly plectenchymatous. Finally, *elegantula* differs by the pale lower surface which, for the greater part, is black in the species mentioned above. I do take this feature to be a very reliable distinguishing mark, although I once met with some specimens showing a pale lower surface mottled with black.

Though I do not think that *elegantula* is liable to be confused with *exasperatula,* yet it may be of some use to mention that in a few specimens examined some of the isidia are broadened and furcate towards their apices, looking like those of *exasperatula.* They remain by far in the minority, however, and, to enumerate some more differences, they usually are not shiny, and when broken off it does not look as if there is a medullary cavity. Furthermore, the isidia cover the thallus more uniformly in *P. elegantula* than in *P. exasperatula.* To be sure, the anatomical difference between both species is only slight, but I have not yet seen an exception to the rule that the medulla is thicker in *elegantula* than in *exasperatula.*

Probably connected with this feature is the fact that in *P. exasperatula* the thallus looks more papery thin, and is less appressed to the substratum than in *elegantula,* usually having its margins more raised and undulate.

It may be observed that in sheltered places the isidia may develop to a considerable length, whilst they remain much shorter and have more incrassate apices when exposed to the pressure of the wind.

Groningen: Ter Apel, 26 I 1907, *Tresling* (TA).

Drente: Uffelte, 16 VIII 1922, *Ten Kate* (L).

Overijsel: Diepenheim, 21 VII 1941, *Maas G. 1188a* (L); Markelo, 23 VII 1941, *Maas G. 1243* (L).

Gelderland: Doornspijk, 25 IV 1942, *Maas G. 1846* (L, VS).

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 686a, 681* (L); Baarn, Groeneveld, 7 II 1943, *Maas G. 2271a* (L); De Bilt, 19 I 1930, *Wassink 137* (Wask); De Bilt, Beerschoten, 14 I 1930, *Wassink 212* (Wask).

Zuid-Holland: Leiden, 15 VIII 1943, *Maas G. 2737* (L); Oud Ade, Vennemeer, 10 V 1942, *Maas G. 1904* (L); De Zilk, 26 V 1947, *Maas G. 3700* (L).

Limburg: Epen, 13 V 1944, *Barkman* (L); Kamerig, 7 VII 1942, *Van Rossem 212, 213, 228a* (L); 13 VII 1942, *Maas G. 2016* (L); Terziet, Bovenste bosch, 16 VII 1942, *Maas G. 2034b* (L); Wijlre, Beertsenhoven, 9 VII 1942, *Van Rossem 215* (L).

var. **isidioidea** (Oliv.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 148; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 516 — *Parmelia subaurifera* var. *fuliginosa* f. *isidioidea* Oliv., Fl. Lich. Orne, vol. 1, 1882, p. 73 — *Parmelia subaurifera* f. *isidioidea* (Oliv.) A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 119.

Thallus covered with a dense isidiose cushion. Medulla C + red.

Remarks. Even more than var. *elegantula* this variety is apt to be mistaken for such *Melaenoparmeliae* as *P. fuliginosa* var. *fuliginosa* and var. *laetevirens,* and *P. subaurifera* f. *fuliginoides,* since the difference of the medullary reaction does not hold any more. We have now to rely upon the other distinguishing marks mentioned above, and I am inclined to consider the colour of the lower surface a good one.

Limburg: Hoogcruts, 17 VII 1942, *Maas G. 2048* (L).

12. Parmélia fuliginosa (Fr.) Nyl. in Flora, vol. 51, 1868, p. 346; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 87; vol. 8, 1932, p. 558 et vol. 10, 1940, p. 518 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 149 — *Parmelia olivacea* var. *fuliginosa* Fr. apud Duby in De Cand. et Duby, Bot. Gall., ed. 2, vol. 2, 1830, p. 602.

Macroscopical description. Thallus foliaceous, up to 6 or 8 cm in diam., growing in rosettes which may coalesce, closely appressed, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, rather soft and flexible, up to 8 mm long, 0.5—1.5 mm broad, flat, somewhat convex or wavy, sometimes folded in the centre, contiguous or overlapping, irregularly incised. Margins flat or somewhat curved downwards, entire or irregularly crenate. Tips appressed or raised, broadened up to 2 or 3 mm, fan-shaped, broadly lobate or crenate or incised. Upper side of the lobes pale olive to dark brown or nearly black, dull and sometimes slightly wrinkled in the centre (as far as visible), more or less strongly shiny and smooth, uneven or faintly dented at the tips, without soredia and cortical cracks, either devoid of isidia or densely isidiate. Isidia laminal and sometimes marginal, concolorous with the thallus or darker, small and wart-like, or longer, up to 0.5 mm long, cylindrical or club-shaped (isidia cylindrica vel ± claviformia), simple or branched. Lower side of the lobes black, shiny, somewhat wrinkled and densely rhizinose in the centre, brown to pale brown, shiny, smooth or slightly veined at the tips, and with a more or less narrow zone free from rhizinae or warts. Rhizinae black, simple or furcate at their apices. *Microscopical description.* Upper cortex pale brown or colourless with dark brown exterior zone, paraplectenchymatous, one-layered, 3—9 μ. Gonidia bright green, spherical, 8—15 μ, arranged in clusters or in a continuous layer of 30—60 (—100) μ. Medulla colourless, white in reflected light or rusty yellow in the lower part, densely plectenchymatous, 60—120 μ, composed of pachydermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 1-layered, 6—9 μ. *Apothecia* very rare, never met with in recent times in Holland, laminal, sessile, saucer-shaped, up to 2 mm in diam. Amphithecium concolorous with the thallus or somewhat paler, faintly shiny, smooth or grooved. Margin persistent, entire or crenate, either provided with short isidia or not. Disc dark brown, slightly shiny, epruinose, flat, smooth. Epithecium yellow-brown, hymenium colourless, hypothecium colourless, with a gonidial layer underneath. Hymenium 45—75 μ. Asci cylindrical to almost clavate, ± 15 × 30—45 μ. Spores not observed. Paraphyses septate, conglutinate. *Pycnides* not seen.

Chemical constituents and reactions. Upper cortex N + red-brown, otherwise unaltered by the usual reagents. Medulla C + red. Judging from the reaction upon N, the colour of the upper cortex is due to parmelia brown. According to Zopf (Flechtenstoffe, 1907, p. 135) who examined var. *ferruginascens* of this species, it contains lecanoric acid ($C_{16}H_{14}O_7$), a compound reacting upon C with a red colour.

Distribution. Widely distributed all over Europe.

Remarks. The variability of *P. fuliginosa* appears to be less in Holland than it is abroad; nevertheless, the forms which do occûr in this country show considerable differences. According to the colour of the upper surface, the species may be roughly divided into two types, viz. the pale and the dark type. The former is represented by the varieties *glabratula* (devoid of isidia) and *laetevirens* (isidiate), the latter by var. *fuliginosa.* Minor deviations occur in var. *laetevirens* and in var. *fuliginosa.*

In Liebig's Ann. Chem., vol. 306, 1899, p. 316, Zopf describes a new variety, var. *ferruginascens*, which is characterised by the presence of rusty spots in the lower part of the medullary tissue. According to Rosendahl (in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, p. 444), it would also be characterised by its spores being somewhat smaller than in var. *fuliginosa.* Afterwards (Cat. Lich. Univ., vol. 6, 1929, p. 88), Zahlbruckner considered it a form, creating the combination f. *ferruginascens* (Zopf) A. Zahlbr. Properly speaking, this form should be treated as any other form of *fuliginosa.* Yet, there are some objections which eventually made me look upon f. *ferruginascens* (Zopf) A. Zahlbr. as a modification due to some chemical influence or other. First, I have found thalli whose medulla was rusty-yellow in those places only which were affected by some *Thrips* species which feed on the lower cortex. Secondly, whereas f. *ferruginascens* is supposed to be exclusively saxicolous, a rusty medulla is not confined to saxicolous plants; it also occurs in arboricolous specimens, in var. *fuliginosa* as well as in var. *laetevirens.*

Key to the varieties and forms.

1a. Thallus destitute of isidia or almost so . . var. **glabratula** (Lamy) Oliv.
1b. Thallus isidiate 2
  2a. Upper side of the thallus pale olive 3
    3a. Isidia cylindrical, slender
      var. **laetevirens** Flot. ex. Nyl. f. **eu-laetevirens** Maas G.
    3b. Isidia swollen at their apex, clavate
      var. **laetevirens** Flot. ex. Nyl. f. **robustior** Harm.
  2b. Upper side of the thallus dark-coloured 4
    4a. Thallus with isidia only
      var. **fuliginosa** (Fr.) Maas G. f. **eu-fuliginosa** Maas G.
    4b. Thallus isidiate with folioles intermixed
      var. **fuliginosa** (Fr.) Maas G. f. **sublaciniosa** Erichs.

var. **fuliginosa** (Fr.) Maas G. nov. comb. — *Parmelia olivacea* var. *fuliginosa* Fr. apud Duby in De Cand. et Duby, Bot. Gall., ed. 2, vol. 2, 1830, p. 602.

Lobes contiguous or overlapping at the tips. Upper surface dark olive-green or olive-brown to dark brown or almost black, densely isidiate.

Remarks. *Parmelia fuliginosa* var. *fuliginosa* varies with regard to its isidia and its colour. In places exposed to strong winds, on solitary trees for instance, or at the outskirts of woods, the isidia are usually short, and not infrequently somewhat incrassate at their apices. In more sheltered places, however, they are long and slender. Our saxicolous specimens usually have long isidia which might point at a sheltered habitat, and, as a matter of fact, the boulders on which they are found project only little above the ground.

As a rule, sun-exposed specimens are the darker ones, in some cases being almost black. Whether these dark plants belong to f. *aterrima* (Wedd.) Harm. (Lich. France, vol. 4, 1909, p. 548) I do not know.

The isidia of *P. fuliginosa* are very brittle, easily breaking off. The white medulla then shown delusively resembles soredia which makes especially this variety resemble very much *P. subaurifera* f. *fuliginoides*. In the latter, however, the warts near the tips of the lobes are broad, and in course of time they burst and actually become sorediose, giving the typical dusty appearance to the thallus. Moreover, marginal soralia are not rare in f. *fuliginoides*. Finally, the lobes of *fuliginoides* have more broadly lobate or rounded tips, and are less shiny than those of *fuliginosa*.

var. **fuliginosa** f. **eu-fuliginosa** Maas G. nov. f. — *Parmelia fuliginosa* var. *typica* Degel. in Bergens Mus. Årb., (1934) 1935, no. 3, p. 24, nomen nudum.

Typus: the same as of *Parmelia olivacea* var. *fuliginosa*.

Iconography: Rosend. in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 11.

Isidia extremis loborum partibus sparsa, minuta, centro thalli longiora, cylindrica, gracilia, in crustam continuam vel areolatam conferta.

Isidia scattered and wart-like at the tips of the lobes, crowded, longer, cylindrical and slender in the centre of the thallus, forming a continuous or areolate crust.

Ecology and frequency. Saxicolous as well as arboricolous, upon boulders (mainly the cairns [cf. p. 22] in the province of Drente, and in a few places along the IJselmeer), and on several species of deciduous trees, not uncommon.

Remarks. I once met with a peculiar specimen (Zeyen, 4 V 1941, no. 867) deviating in that the upper surface was completely wrinkled and warty.

Drente: Anloo, 3 V 1941, *Maas G. 747* (L); Assen, 2 V 1941, *Maas G. 722,* transition to var. *laetevirens* f. *eu-laetevirens* (L); Balloo, 2 V 1941, *Maas G. 731* (L); Bronneger, 6 V 1941, *Maas G. 969* (L); Buinen, 17 VII 1939, *Van Ooststroom & Zaneveld* (L); 6 V 1941, *Maas G. 998* (L); Diever, 2 VIII 1941, *Maas G. 1501* (L); Drouwen, Drouwenerveld, 6 V 1941, *Maas G. 964* (L); Eext, 5 V 1941, *Maas G. 928* (L); Emmen, 15 VII 1939, *Van Ooststroom & Zaneveld* (L); Emmen, Schimmeresch, 8 V 1941, *Maas G. 1089* (L); Havelte, 2 VIII 1941, *Maas G. 1518, 1520* (L); Midlaren, 5 V 1941, *Maas G. 905, 910* (L); Noordlaren, III 1856, *Acker Stratingh,* c. ap. (Gro); Noordsleen, 9 V 1941, *Maas G. 1110* (L); Rolde, 4 V 1941, *Maas G. 785* (L); Valthe, 7 V 1941, *Maas G. 1069* (L); Valthe, Valtherveld, 7 V 1941, *Maas G. 1016* (L); Zeyen, 4 V 1941, *Maas G. 867* (L).

Overijsel: Diepenheim, 20 VII 1941, *Maas G. 1182b,* transition to f. *sublaciniosa* (L).

Gelderland: Doornspijk, 25 IV 1942, *Maas G. 1834* (L); IV 1942, *Maas G. & Van Soest* (VS); Hierden, Hoophuizen, 24 X 1941, *Maas G. 1582,* transition to var. *laetevirens* f. *eu-laetevirens* (L); Hoef, 25 X 1941, *Maas G. 1617a* (L); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2368,* transition to var. *laetevirens* f. *eu-laetevirens* (L); Putten, 26 III 1921, *Ten Kate* (L).

Utrecht: Woudenberg, 11 IV 1944, *Agsteribbe,* transition to var. *laetevirens* f. *eu-laetevirens* (L).

Zuid-Holland: Wassenaar, Duinrel, 24 X 1942, *Maas G. 2334,* transition to var. *laetevirens* f. *eu-laetevirens* (L).

Limburg: Krapoel, 15 VII 1942, *Maas G. 2030* (L); Terziet, Bovenste bosch, 16 VII 1942, *Maas G. 2034a* (L).

var. **fuliginosa** f. **sublaciniosa** Erichs. in Mem. Soc. F. Fl. Fenn., vol. 12 (1935/1936) 1936/1937, p. 10; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 518.

Thallus with folioles interspersed in between the isidia. Folioles concolorous with the upper side, oval or roundish, margins crenate.

Ecology. On wayside trees.

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1138* (L); 21 VII 1941, *Maas G. 1188b* (L).

var. **glabratula** (Lamy) Oliv. in Rev. de Bot., vol. 12, 1894, p. 70; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 152; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 518 — *Parmelia fuliginosa* subsp. *glabratula* Lamy in Bull. Soc. Bot. France, vol. 30, 1883, p. 353 — *Parmelia glabratula*; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 92 et vol. 8, 1932, p. 560 (ubi lit. et synon.).

Iconography: Rosend. in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 9.

Thallus pale olive-green or olive-brown, shiny, without isidia or nearly so. Isidia, if present, in small numbers only, sometimes marginal, giving the tips of the lobes a spinous appearance.

Ecology and frequency. Corticolous, in sheltered and shaded places, in woods, rare.

Remarks. Numerous intermediate stages between this variety and the following are known.

Gelderland: Apeldoorn, 't Loo, 1 VI 1852, *Van Hall*, transition to var. *laetevirens* f. *eu-laetevirens* (NBV); Doornspijk, Nieuw Soerel, 25 IV 1942, *Van Soest* (L); Ellekom, De Steenkuilen, 14 VI 1943, *Maas G. 2586* (L).

Noord-Brabant: Bergen op Zoom-Woensdrecht, 11 XI 1943, *Maas G. 2899* (L).

var. **laetevirens** Flot. ex Nyl. in Bull. Soc. Linn. Normand., ser. 2, vol. 6, 1872, p. 272; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 89 et vol. 10, 1940, p. 518 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 152 — *Imbricaria olivacea* var. *laetevirens* Flot. in Jahresber. Schles. Ges. vaterl. Kult., vol. 28, 1850, p. 131, nomen nudum.

Lobes pale olive-green or olive-brown, shiny, isidiate. Isidia laminal, frequently also marginal.

Remarks. Mostly only the second author is mentioned, though Nylander gave Flotow credit for the varietal epithet. I think it will make only a slight alteration of the reading of article 48 of the Rules of Nomenclature to apply it in this case.

var. **laetevirens** f. **eu-laetevirens** Maas G. nov. f.

Typus: the same as of *Imbricaria olivacea* var. *laetevirens*.

Isidia elongata, procera, ramosa.

Isidia long, slender, branched.

Ecology and frequency. Corticolous, in open woods, or at least in sheltered places, not uncommon.

Remarks. Transitions to var. *fuliginosa* f. *eu-fuliginosa* and to var. *glabratula* are numerous. Typical *laetevirens* seems to me to be less densely isidiate than *eu-fuliginosa*. The marginal isidia which frequently occur, and the laminal ones which may have an irregular growth give a shaggy and spiny appearance to the thallus by which it may be told from *P. subaurifera* f. *fuliginoides*. Moreover, in *laetevirens* there are neither soralia nor warts which burst and become sorediose. From *P. elegantula* (varieties *elegantula* and *isidioidea*) it may be distinguished by its lower surface being black for the greater part, and by its lobes being more shiny.

Groningen: Groningen, Sterrebosch, III 1855, *Acker Stratingh* (NBV); *Acker Stratingh*, c. ap., identity not quite certain (Gro).

Drente: Ansen, 2 VIII 1941, *Maas G. 1523* (L).

Overijsel: Beckum, 22 VII 1941, *Maas G. 1234* (L); Zwolle, III 1909, *Lako* (NBV); III 1913, *Lako*, transition to var. *glabratula* (L); Zwolle, Engelsche Werk, I 1913, *Lako* (L).

Gelderland: Doorwerth, Duno-Heveadorp, 9 II 1941, *Stafleu* (U); Ellekom, Onzalige Bosch-Hagenau, 14 VI 1943, *Maas G. 2587*, transition to var. *glabratula* (L); Elspeet, Elspeeter bosch, 27 X 1941, *Maas G. 1723* (L); Garderen, 4 I 1940, *Stafleu* (U); Hierden, Hoophuizen, 24 X 1941, *Maas G. 1582* (L); Hierden, Hulshorst, 24 X 1941, *Maas G. 1561* (L); Kotten, Wiltershaar, 13 IV 1941, *Stafleu* (U); Nijmegen, 6 IX 1873, *Van Hall*, c. ap. (L); Nijmegen, Berg en Dal, 25 VIII 1873, *Van Hall* (L); Nijmegen, Meerwijk, VII 1873, *Van Hall* (NBV); 24 VII 1873, *Van Hall*, c. ap. (L); VIII 1890, *Top* (L).

Utrecht: Amersfoort, *Bondam* (NBV); Baarn, Groeneveld, 7 II 1943, *Maas G. 2264, 2270* (L); Bunnik-De Bilt, 11 X 1942, *Van Rossem 332* (L); Huis ter Heide, VII, 15 VIII 1859, *Van Hall* (NBV); Zeist, *Molkenboer* (L).

Zuid-Holland: Wassenaar, Meiendel, 19 IV 1942, *Maas G. 1817* (L).

Zeeland: Walcheren, Middelburg-Nieuw en St. Joosland, 13 III 1942, *Brakman* (L).

Noord-Brabant: Baarschot, de Haardgang, 17 XI 1943, *Barkman 684* (L).

Limburg: Vijlen, Kerperbosch, 13 VII 1942, *Maas G. 2023* (L).

var. **laetevirens** f. **robustior** Harm., Lich. France, vol. 4, 1909, p. 548; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 90 et vol. 10, 1940, p. 518; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 153.

Thallus resembling that of f. *eu-laetevirens,* but the isidia are swollen and incrassate at the apex.

Remarks. Though this form has been described to be arboricolous, both Hillmann (l. c. p. 153) and I found saxicolous specimens which, according to their *exasperatula*-like isidia, might be assigned to f. *robustior.*

Gelderland: Hoef, 25 X 1941, *Maas G. 1617b* (L).

13. **Parmelia isidiotyla** Nyl. in Flora, vol. 58, 1875, p. 8; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 94 (ubi lit. et synon.) — *Parmelia glomellifera* Nyl. in Flora, vol. 64, 1881, p. 453; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 92 et vol. 10, 1940, p. 520 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 153.

Macroscopical description. Thallus foliaceous, up to 20 cm in diam. (usually much smaller in Holland), growing in rosettes, more rarely irregularly wide-spreading, closely appressed, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, rather soft, about 1 cm long or less, but difficult to follow down to the base, 0.4—1 mm broad, flat, convex or wavy, not infrequently folded, especially towards the centre of the thallus, contiguous or overlapping at the tips, irregularly or pinnately incised or branched. Margins flat, entire, somewhat crenate or densely and minutely incised. Tips more or less appressed, broadened up to about 3 mm, fan-shaped, broadly lobate or crenate. Upper side of the lobes olive-brown to dark brown or greyish, with a narrow dark zone along the tips, entirely dull, or faintly to strongly shiny and almost smooth to dented at the tips, more or less dull and usually wrinkled toward the centre of the thallus, sometimes minutely cracked, in a single case caesio-pruinose at the tips, isidiate and sorediate. Isidia laminal, concolorous with the thallus, frequently starting from ridges, at first small, wart-like and single, but soon becoming larger and coralloid towards the centre, coalescing into clusters which eventually may cover the whole of the surface. Frequently, the isidia burst spontaneously at their apices, becoming albo-sorediose, in other cases they break off by some mechanical cause. Lower side of the lobes brown, shiny, and smooth or dented at the tips, black, more or less dull and somewhat wrinkled in the centre, densely rhizinose. Rhizinae black. *Microscopical description.* Upper cortex yellowish with darker exterior zone, paraplectenchymatous, 15—20 μ. Gonidia bright green, spherical, 6—12 μ, arranged in a layer of 30—50 μ. Medulla colourless, white in reflected light, or yellowish to pink, densely plectenchymatous, 60—100 μ, consisting of pachydermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 12—18 μ. *Apothecia* and *pycnidia* not observed.

Chemical constituents and reactions. Upper cortex K —, C + blue-grey, N + blue, next violet, then grey. Medulla K —, C —, KC — or + pink, Pd —. As stated by Zopf (Flechtenstoffe, 1907, p. 262, 295, 418), this lichen species contains glomelliferic acid ($C_{19}H_{22}O_6$) which becomes reddish with KC, and glomellic acid. According to the reaction upon C and N, the colour of the upper cortex is due to glomellifera brown (see Bachmann in Jahrb. wiss. Bot., vol. 21, 1889, p. 39). It is not known, however, whether the latter constituent has something to do with glomellic acid.

Distribution. No records of this species are known from some East European states, such as Rumania and Yugoslavia, though this does not necessarily imply that *P. isidiotyla* is really missing there. In the rest of Europe it is a common species, on the understanding that it prefers the lower altitudes. So much the more curious it is that *isidiotyla* should be lacking in Belgium, Great Britain and Luxemburg.

Remarks. Though *P. isidiotyla* shows some variability in morphological as well as in chemical respect, none of the varieties or forms described in literature I am able to recognise in the indigenous material. Some forms of minor importance are f. *anerythrophora* and f. *erythrophora*. Both were established by Harmand (Lich. France, vol. 4, 1909, p. 539), and they differ in that in the former the medulla remains unchanged when treated with KC ("Cette forme peut être considérée comme le type"), whereas in the latter the medulla turns pink.

Concerning this difference in chemical behaviour of the medulla, there is a much more important question, since it bears upon the intricate case *isidiotyla-glomellifera*. The latter name for the first time appeared as a varietal epithet established by Nylander in *P. prolixa* (in Flora, vol. 62, 1879, p. 223), but it was afterwards raised to specific rank by the same author (in Flora, vol. 64, 1881, p. 453). According to Nylander, it is characterised by its medullary reaction (KC + "erythrinose saltem leviter tincta"), and by its isidia being much thinner than those of *P. isidiotyla* which, in addition, have the tendency of becoming servediose at the apex. Hillmann, however, who presumably by way of precaution still considers *isidiotyla* to be a variety of *glomellifera* — though the reverse sequence would be the more natural thing — justly questions the value of the distinguishing marks: "Wenn man jedoch ein reiches Material durchsicht, gelingt es nicht, nach diesen Angaben beide Flechten zu unterscheiden". Now, from the Dutch material, if not rich at all, I likewise have the impression that thin isidia, thick isidia becoming servediose, and medullary reaction, are all features which may vary independently one of the other. Would it not be reasonable, then, to consider *glomellifera* identical and synonymous with *isidiotyla*!

If developed in full, there is little trouble in distinguishing between *P. isidiotyla* and *P. prolixa* which latter shows no trace of isidia or soredia. Not infrequently, however, transitional stages are met with (see Anders, Strauch- u. Laubfl. Mitteleurop., 1928, p. 157; remarks to f. *dissecta* Hilitz. in Hillm. l. c. p. 155!), which diminish the difference and make the specific status of *isidiotyla* a dubious one. A similar case is, amongst others, encountered in *Peltigera canina* and *Peltigera subcanina*. Whereas, for reasons to be mentioned later on, I do not hesitate in subordinating the latter to *P. canina*, I wonder, after all, whether we had not better consider *isidiotyla* a variety of *P. prolixa* as was already hinted at by Nylander; in anatomical respect the difference between them is only slight indeed.

var. **glomellifera** (Nyl.) Maas G. nov. comb. — *Parmelia prolixa* var. *glomellifera* Nyl. in Flora, vol. 62, 1879, p. 223.

Margins of the lobes entire or somewhat crenate. Upper side olive-brown to dark brown, with more or less shiny tips.

var. **glomellifera** f. **eu-glomellifera** Maas G. nov. f.

Typus: the same as the type of *Parmelia isidiotyla.*

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 23, fig. 7; Rosend. in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 7; Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 3, fig. 1.

Thallus supra epruinosus. Medulla C —.

Upper side of the thallus epruinose. Medulla C —.

Ecology and frequency. Exclusively saxicolous, at least in Holland, growing on granite, basalt, and, more rarely, on bricks or tiles. Rare, except in the province of Drente where it is generally found on the boulders of the cairns (cf. p. 22).

Remarks. As already stated by Tavares (in Portugal. Act. Biol., vol. 1 B, 1945, p. 78), *P. isidiotyla* must be looked upon as a heliophilous and nitrophilous species. Actually, in Holland it may be found on the top as well as on the sides facing south and east of the boulders of the cairns which, frequently being the only elevation in a flat and open area, provide a favourite perch to various birds. As a result, most of the boulders show the traces of these avian visits in that they are more or less covered with excrements on which *P. isidiotyla* is supposed to thrive.

As regards the difference from *P. disjuncta,* see there.

Drente: Angelsloo, 15 VII 1939, *Van Ooststroom & Zaneveld 7504, 7514, 7515, 7517* (L); 8 V 1941, *Maas G. 1100, 1100a, 1106* (L); Anloo, 3 V 1941, *Maas G. 746* (L); Buinen, 17 VII 1939, *Van Ooststroom & Zaneveld 7509* (L); Diever, 2 VIII 1941, *Maas G. 1500* (L); Eext, 5 V 1941, *Maas G. 933* (L); Emmen-Odoorn, 16 VII 1939, *Van Ooststroom & Zaneveld 7513* (L); Emmen, Emmerveld, 16 VII 1939, *Van Ooststroom & Zaneveld 7510* (L); Gieten, 3 V 1941, *Maas G. 783* (L); Havelte, 10 VII 1939, *Van Ooststroom & Zaneveld, 7506* (L); 2 VIII 1941, *Maas G. 1519* (L); Loon, 18 VII 1939, *Van Ooststroom & Zaneveld 7507* (L); 10 V 1941, *Maas G. 1123* (L); Midlaren, 5 V 1941, *Maas G. 906, 912* (L); Noordloo, 3 V 1941, *Maas G. 781* (L); Noordsleen, 9 V 1941, *Maas G. 1109* (L); Schoonoord, 17 VII 1939, *Van Ooststroom & Zaneveld 7505* (L); Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld 7511, 7516* (L); 7 V 1941, *Maas G. 1057* (L); Westenesch, 8 V 1941, *Maas G. 1094* (L); Zeyen, 18 VII 1939, *Van Ooststroom & Zaneveld 7508* (L); 4 V 1941, *Maas G. 806* (L).

Utrecht: De Bilt, III 1841, *Van der Sande Lacoste,* identity uncertain (NBV); Grebbe, Grebbeberg, 2 VII 1942, *Maas G. 1982* (L); Loosdrecht, 1847, *Van der Sande Lacoste* (NBV).

Limburg: Mook, Plasmolen, 8 IV 1942, *Stafleu* (U).

14. Parmelia disjuncta Erichs. in Ann. Mycol., vol. 37, 1939, p. 78. — *Imbricaria sprengelii* (Flk.) Körb., Syst. Lich. German., 1855, p. 80; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 19 — *Parmelia sorediata* var. *coralloidea* Lynge in Rep. Sci. Results Norweg. Exped. Novaya Zemlya 1921, no. 43, 1928, p. 200; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 113 et vol. 10, 1940, p. 535; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 159 — *Parmelia granulosa* Lynge in Skr. Svalbard og Ishav., no. 41, 1932, p. 74; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 560 et vol. 10, 1940, p. 520.

Iconography (most probably): Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 23, fig. 8; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 22, fig. 4; Rosend. in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 6.

Macroscopical description. Thallus foliaceous, a few cm in diam., growing in rosettes, but soon fusing into larger and irregular patches, appressed, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, rather soft, up to 5 mm long, 0.2—0.6 mm broad, flat or convex, at the tips discrete, contiguous or overlapping, irregularly or pinnately branched. Margins flat, entire. Tips loosely adhering to ascending, either broadened up to 1 mm or not, crenate or incised. Upper side of the lobes dark olive-brown to almost black-brown, shiny and smooth or dented at the tips, dull and smooth or uneven in the centre of the thallus, isidiate and sorediate. Isidia laminal and subapical, concolorous with the thallus, verrucose, hemispherical or somewhat depressed, 0.1—1 mm broad, bursting at their apex and turning into greyish or whitish soredia, frequently uniting and forming clusters or larger patches. Lower side of the lobes black, at most brownish at the tips, faintly shiny, smooth, veined or somewhat wrinkled, rhizinose. Rhizinae black, simple or furcate. *Microscopical description.* Upper cortex colourless with a brownish exterior zone, paraplectenchymatous, 9—12 (—15) μ. Gonidia bright green, spherical, 9—16 μ, arranged in a layer of 30—50 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 30—60 μ, consisting of pachydermatous hyphae. Lower cortex black-brown, paraplectenchymatous, 9—12 (—15) μ. *Apothecia* and *pycnidia* not observed.

Chemical constituents and reactions. Upper cortex N + red-brown, otherwise indifferent to the usual chemicals, as is the medulla. Zopf (Flechtenstoffe, 1907, p. 287, 419), who studied "*Parmelia sorediata*", identified the presence of diffusic acid ($C_{31}H_{38}O_{10}$), but it is not known, of course, whether his investigation referred to *P. disjuncta* or to *P. sorediata* s. str. According to the cortical reaction upon N, *Parmelia disjuncta* owes its dark colour to parmelia brown.

Distribution. As it is only a short time since the intricate question about *Parmelia disjuncta* and *Parmelia sorediata* was definitely settled, it is small wonder that little is known yet about the distribution of the former species. As stated by Erichsen (l. c.), all of the specimens hitherto known from Germany belong to *P. disjuncta*. Yet, it is held that *P. sorediata* s. str. does occur in the Central European Alps (Almborn in litt.), and as a matter of fact, the specimen in Körber's "Typenherbar" which was collected by Arnold in Tyrol is genuine *sorediata*. On the whole, however, Erichsen may be right in assuming that in Central Europe it is *P. disjuncta* which takes the place of *P. sorediata*, and this particularly holds for the lowlands. As O. Almborn wrote in a letter to me, both species are equally common in Scandinavia. Finally, it may be observed that neither of them are known from Portugal (see Tavares in Portugal. Act. Biol., vol. 1 B, 1945).

Ecology and frequency. Exclusively saxicolous; this species has been found only twice on granitic boulders of the cairns, but it has possibly been overlooked elsewhere.

Remarks. It seemed long established that *Parmelia sorediata* (Ach.) Röhl. was a homogeneous species until Lynge came to the conviction, at first hesitatingly (in Rep. Sci. Results Norweg. Exp. Nov. Zemlya 1921, no. 43, 1928, p. 199—200), afterwards definitely (in Skr. Svalbard og Ishav., no. 41, 1932, p. 74—75) that there are two distinct species, viz. *P. sorediata* s. str. and *P. granulosa* (= his former *P. sorediata* var. *coralloidea*). Erichsen, however, proved *P. granulosa* to be a later homonym, and proposed the present epithet *disjuncta*. According to this author, all of the German specimens belong to *P. disjuncta*, so it would only seem natural that our specimens likewise belong here. Unfortunately however, Erichsen did not mark the difference between *disjuncta* and *sorediata* s.str., whereas little can be understood from Hillmann's descriptions of *P. sorediata* and var. *coralloidea*. It is through the kind help of Mr Almborn's, who provided me with material of both species and with copies of the papers by Lynge which were inaccessible to me, that I am able with certainty to refer the Dutch specimens to *P. disjuncta*.

From *P. isidiotyla* this species may be distinguished in the field in that its lobes are darker and more finely incised. From the equally dark saxicolous *P. fuliginosa* it may be told by its tiny, frequently clustered isidia.

Drente: Borger, 2 VIII 1837, *Van Hall* (NBV); Buinen, 6 V 1941, *Maas G. 997* (L).

15. **Parmelia subaurifera** Nyl. in Flora, vol. 56, 1873, p. 22; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 117; vol. 8, 1932, p. 568 et vol. 10, 1940, p. 536 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 160.

Macroscopical description. Thallus foliaceous, up to about 6 cm in diam., growing in rosettes or irregularly wide-spreading, appressed, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, rather soft, up to 1 cm long, about 2 mm broad, flat or somewhat wavy towards the centre, contiguous or overlapping at the tips, irregularly or pinnately branched. Margins flat or ascending, entire or irregularly crenate. Tips loosely adhering or raised, broadened up to 5 mm, broadly rounded or lobate. Upper side of the lobes leathery yellow, olive-brown to almost dark brown, in light-coloured specimens frequently with a tanned margin, entirely dull or slightly shiny mainly at the tips, usually somewhat wrinkled and dented, isidiate as well as sorediate. Isidia laminal, usually darker than the thallus, easily breaking off and turning yellowish-sorediose. Soralia laminal and not infrequently marginal, at first dark brown, granular, and quite resembling broad complex warts (soralia isidialia), measuring up to 0.5 mm, later on lemon-yellow to whitish and dusty by abrasion, more or less confluent. In extreme cases the centre of the thallus is partly or wholly covered with a sorediose crust. Lower side of the lobes black in the centre of the thallus, brown at the tips, shiny, smooth or finely wrinkled, densely rhizinose. Rhizinae black, simple or furcate. *Microscopical description.* Upper cortex brownish, paraplectenchymatous, one-layered, 3—9 μ. Gonidia bright green, spherical, 6—15 μ, arranged in a layer of 30—50 μ. Medulla colourless, white or yellowish in reflected light, thinly plectenchymatous, 60—90 μ, composed of leptodermatous hyphae. Lower cortex dark brown, paraplectenchymatous, one-layered, about 6 μ. *Apothecia* and *pycnides* not seen.

Chemical constituents and reactions. Upper cortex N + red-brown, otherwise chemically indifferent. Medulla K —, C + red, KC —, Pd —. According to Zopf (Flechtenstoffe, 1907, p. 124, 135, 418), this species contains subauriferin which accounts for the sulphureous colour of the soredia and the medulla, and lecanoric acid ($C_{16}H_{14}O_7$) which becomes red with C. The reaction of the upper cortex upon N indicates the presence of parmelia brown.

Distribution. The species occurs throughout Europe.

Remarks. As stated before, there are, beside plants with yellow soredia, white-sorediose specimens. Gasilien looked upon these as a separate form, establishing the name f. *albo-sorediosa* (in Act. Soc. Linn. Bordeaux, vol. 53, 1898, p. 63). Hillmann took over this form, though at the same time he advanced the idea that the white colour of the soredia could rather be brought about by mechanical abrasion. In fact, in yellow-sorediose plants white soralia may be seen as well. It has been stated by Zopf (l. c.) that the brimstone-yellow colour of the soredia is due to the lichen acid subauriferin. As usually is the case with lichen acids, the quantity of subauriferin may, among others, very well depend on climatic factors of the habitat. In my eyes it is these factors which go far in explaining the fact that in Holland the albo-sorediose plants greatly outnumber the yellow-sorediose ones. It may, moreover, be noted that white soralia are not restricted to plants belonging to f. *subaurifera,* they also occur in f. *fuliginoides.*

Key to the forms.

1a. Thallus without secondary laciniae in between the isidia 2
    2a. Isidia extremely small and minute, simple f. **subaurifera** (Arn.) Maas G.
    2b. Isidia at least in the centre of the thallus elongate, usually furcate, densely packed . . . . f. **fuliginoides** (Bouly de Lesd.) A. Zahlbr.
1b. Thallus with secondary laciniae interspersed between the isidia f. **laciniata** Maas G.

f. **subaurifera** (Arn.) Maas G. nov. comb. — *Imbricaria glabra* var. *subaurifera* Arn. in Verh. Zool.-Bot. Ges. Wien, vol. 25, 1875, p. 492.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 22, fig. 11; Rosend. in Nov. Act., Abh. Kais. Leop.-Carol. Deutsch. Akad. Naturf., vol. 87, 1907, tab. 28, fig. 2.

Isidia extremely small and minute, more or less scattered at the tips of the lobes, becoming more or less crowded towards the centre of the thallus, simple.

Ecology and frequency. On deciduous and coniferous trees or upon wood, rather common throughout the country. A comparatively fast grower, even occurring on twigs — mainly in copses of *Quercus robur* — which are only a few years of age.

Remarks. I consider this form to correspond with the type of *Parmelia subaurifera.* The choice of this subdivisional epithet may need some explanation. Zahlbruckner (Cat. Lich. Univ., vol. 6, 1929, p. 118) mentions for synonyms earlier than Arnold's: *Imbricaria olivacea* var. *nuda* f. *rugosa* Flot. and *Imbricaria olivacea* var. *vulgaris* (subvar.?) *corticola* f. *furfuracea* (Schaer.) Hepp. The former, however, which was published in Jahresber. Schles. Ges. vaterl. Kult., vol. 28, 1850, p. 131 is a nomen nudum, whereas the latter being labeled to an exsiccatum refers to entirely different species. The specimens preserved in the Rijksherbarium, for instance, belong to *Parmelia verruculifera*. The next oldest synonym to be considered, therefore, is Arnold's variety.

Groningen: Haren, 12 VI 1845, *Van Hall* (NBV); Ter Apel, 19 I 1907, *Tresling* (TA).

Friesland: Gaasterland, 5 IV 1929, *Koopmans* (U); Mirns, 2 XII 1928, *Koopmans* (Koopm); Sexbierum, 25 VIII 1942, *Maas G. 2187* (L).

Drente: Hoogeveen, 12 XII 1940, *Maas G. 251* (L); Norg-Een, 4 V 1941, *Maas G. 883* (L); Paterswolde, IV 1827, *Van Hall* (NBV); Ubbena, 4 V 1941, *Maas G. 803b* (L); Zeegse, 19 IV 1942, *Boessingh* (L).

Overijsel: Kampen, *Bondam* (NBV); VII 1889, *Top* (NBV); Lemele, 28 VII 1941, *Maas G. 1362* (L); Raalte, I 1909, *Lako* (L); Vollenhove, 22 VII 1928, *Koopmans* (Koopm); Zwolle, II 1909, I 1903, *Lako* (L); III 1909, *Lako* (NBV).

Gelderland: Arnhem, VIII 1847, *Bondam* (NBV); Doornspijk, 25 IV 1942, *Maas G. 1844* (L); IV 1942, *Maas G. & Van Soest* (VS); Doornspijk, De Haere, 26 IV 1942, *Maas G. 1874a* (L); IV 1942, *Maas G. & Van Soest* (VS); Doornspijk, Soerel, 25 IV 1942, *Maas G. 1865* (L); IV 1942, *Maas G. & Van Soest* (VS); Doorwerth, *Buse & Buse-Koppiers* (NBV); Harderwijk, *Bondam* (NBV); Nijkerk, 19 IV 1866, *Stolz* (L); Nijmegen, Meerwijk, VIII 1890, *Top* (L); Wageningen, *Buse & Buse-Koppiers* (NBV); Warnsveld, 20 IV 1930, *Wassink 1453* (Wask).

Utrecht: Amersfoort, *Bondam* (NBV); Baarn-Zeist, 1920, *Hart de Ruyter* (U); Jutphaas, De Hoogt, 23 II 1942, *Stafleu* (U); Kockengen, 6 VIII 1943, *Maas G. 2688* (L); Maartensdijk, Eyckestein, 15 II 1941, *Nannenga 1100* (Nga); Utrecht, IX 1837, *Wttewaal* (NBV); 1841, *Van der Sande Lacoste* (NBV); 10 V 1930, *Van Ooststroom 3151* (L); 22 II 1942, *Stafleu* (U); Utrecht, Rijnauwen, 28 V 1941, *Nannenga 1165a* (Nga); Vechten, Houtensche kerkpad, 22 II 1942, *Stafleu* (U).

Noord-Holland: Aerdenhout, 28 VI 1942, *Maas G. 1972* (L); Bergen, 20 IX 1943, *Barkman 600* (L); Haarlem, *Buse* (NBV); *Splitgerber* (L); 1837, *Buse & Gildemeester-Buse* (L); Overveen, 1841, *Buse & Gildemeester-Buse* (NBV); Santpoort, 1838, *Buse & Gildemeester-Buse* (NBV); Terschelling, Koegelwieck, 5 V 1946, *Westhoff 46111b*, transition to f. *fuliginoides* (L); Texel, De Muy, 13 V 1942, *Stafleu*, transition to f. *fuliginoides* (U); Texel, Westerduinen, IV 1940, *Stafleu* (U); Texel, Westermient, 10 V 1942, *Stafleu* (U).

Zuid-Holland: Den Deyl, *Picrot* (NBV); Heikop, *Van Hall* (NBV); Leiden, *Molkenboer* (L); 10 I 1830, *Wttewaal* (NBV); Lisse, Keukenhof, 9 III 1942, *Van Rossem 93* (L); Noordwijk-Noordwijkerhout, 13 II 1944, *Maas G. 2978* (L); Scheveningen, 19 IV 1942, *Maas G. 1816* (L); Warmond, 10 III 1942, *Van Rossem 103a* (L); Wassenaar, 10 I 1830, *Picrot* (NBV); 19 VIII 1944, *Van Soest 917* (VS); Wassenaar, Meiendel, 29 XII 1940, *Maas G. 367* (L); 6 IX 1941, *Maas G. 1421* (L); 15 III 1942, *Van Rossem 73, 92* (L).

Zeeland: Walcheren, Oostkapelle, IV 1877, *Lako* (L); 25 V 1946, *Brakman* (L); Zuid Beveland, *Van den Bosch* (NBV); Zuid Beveland, Goes 12 XI 1943, *Maas G. 2960* (L); *Maas G. 2923*, transition to f. *fuliginoides* (L).

Noord-Brabant: Beek, VIII 1847, *Van den Bosch* (NBV); Bergeyk, 22 VII 1942, *Maas G. 2065* (L); 's Hertogenbosch, IV 1898, *Wakker* (L); Oisterwijk, Heikant, 24 VII 1943, *Maas G. 2651* (L); Westerhoven, 24 VII 1942, *Maas G. 2097* (L).

Limburg: Maastricht, *Franquinet* (L); Valkenburg, 18 V 1929, *Lütjeharms* (L).

f. **fuliginoides** (Bouly de Lesd.) A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 119 et vol. 10, 1940, p. 536; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 162 — *Parmelia subaurifera* var. *fuliginoides* Bouly de Lesd. in Bull. Soc. Bot. France, vol. 71, 1924, p. 20.

Different from f. *subaurifera* by its isidia which, especially towards the centre of the thallus, are longer, reaching up to 0.5 mm, cylindrical, simple or furcate, and much more densely packed so as to form a dark and continuous or areolate cushion-shaped covering.

Remarks. Time and again when finding f. *fuliginoides* we meet with the difficulty of distinguishing it from *P. fuliginosa* var. *fuliginosa* and var. *laetevirens* if the soredia are not too well developed. As a rule it may be accepted that *fuliginoides* is characterised by its lobes having a rounded or broadly lobate tip which is dull or only slightly shiny, and by its dark, broad, coarsely granular warts which look quite different from the tiny ones growing out into isidia. In *P. fuliginosa* var. *fuliginosa* and var. *laetevirens* the lobes have a broadly lobate to crenulate tip which, as a rule, is strongly shiny; warts are small and minute, though broad ones occasionally occur. None of the distinguishing marks is decisive by itself; combined with the others, however, they are of importance.

As to the difference from *P. elegantula*, see there.

Groningen: Beerta, Nieuw Beerta, 22 VIII 1933, *Nannenga, 278b, 297* (Nga).

Friesland: Gaasterland, 1929, *Koopmans* (U).

Drente: Anlo, 3 V 1941, *Maas G. 765* (L); Diever, 10 V 1941, *Maas G. 1127* (L); Dwingelo, 1 IX 1932, *Lütjeharms* (L); 14 XII 1940, *Maas G. 295a* (L); Schipborg, 5 V 1941, *Maas G. 898, 924* (L); Ubbena, 4 V 1941, *Maas G. 800* (L).

Overijsel: Dalfsen, III 1907 (L); Hellendoorn, 26 VII 1941, *Maas G. 1289* (L); Kampen, *Top* (NBV); Oosterholt, IV 1889, *Top* (L); Zeesse, 28 VII 1941, *Maas G. 1370* (L).

Gelderland: Doornspijk, De Haere, 26 IV 1942, *Maas G. 1874b* (L); Harderwijk, *Bondam* (L); Hierden, Hulshorst, 4 IV 1942, *Maas G. 1790* (L); Leuvenum, 28 IV 1919, *Ten Kate* (L); Nijkerk, 17 IV 1866, *Bondam* (L); 29 III 1936, *Nannenga 1230* (Nga); Nijmegen, Berg en Dal, 24 VII 1873, *Van Hall* (L); Nijmegen, Meerwijk, 24 VII 1873, *Van Hall* (L); Wageningen, *Buse* (NBV); I 1920, *Keyzer & Florschütz* (U); Warnsveld, 26 XII 1929, *Wassink 3381* (Wask); 28 XII 1929, *Wassink 3372, 3388* (Wask).

Utrecht: Bunnik, 25 VI 1933, *Nannenga 31* (Nga); Huis ter Heide, *Van Hall* (NBV); Leersum, 20 IV 1941, *Maas G. 699* (L); Maartensdijk, Eyckestein, 3 VII 1934, *Nannenga 366* (Nga); Tienhoven, 6 VII 1942, *Maas G. 1990* (L); Utrecht, IX 1837, *Wttewaal* (NBV); De Vuursche, Lage Vuursche, 15 II 1941, *Nannenga 1121a* (Nga).

Noord-Holland: Aerdenhout, III 1864, *Van Hall* (NBV); Amsterdam, Rustenburgerpad, XI 1848, *Van der Sande Lacoste* (NBV); Callantsoog, Zwanenwater, 23 V 1941, *Schroevers* (L); Haarlem, 1837, *Buse & Gildemeester-Buse* (L); Haarlem, Haarlemmerhout, 1836, *Molkenboer* (NBV); Santpoort, 1838, *Buse & Gildemeester-Buse* (NBV); Terschelling, Koegelwieck, 24 VIII 1938, *Nannenga 1082* (Nga); Texel, Westermient, IV 1940, *Stafleu* (U); Velzen, Breesaap, IX 1847, *Van den Bosch* (NBV).

Zuid-Holland: 's Gravenhage, 10 I 1830, *Pierot* (NBV); Loosduinen, *Top* (NBV); 20 VII 1851, *Abeleven* (NBV); Naaldwijk, IX 1871, *Van der Trappen* (Gro); Noordwijkerhout, 27 VIII 1918, *Ten Kate* (L); Wassenaar, 10 I 1830, *Pierot* (NBV); Wassenaar, Meiendel, 26 III 1941, *Maas G. 599, 603* (L); 5 VII 1941, *Stafleu* (U); 13 VII 1941, *Maas G. 1086* (L).

Zeeland: Walcheren, Arnemuiden, Sloedam, 1 V 1941, *Brakman*, transition to f. *laciniata* (L); Walcheren, Middelburg-Nieuw en St Joosland, 13 III 1942, *Brakman* (L); Walcheren, Nieuw en St Joosland, 25 III 1941, *Brakman* (L); Zuid Beveland, V 1840, *Van den Bosch* (NBV).

Noord-Brabant: Breda, 1812, unio NBV (NBV).

Limburg: Maastricht, *Franquinet* (Maastr).

f. **laciniata** Maas G. n. f.

Typus: Ruigenhoek, 6 VII 1941, *Maas G. 1051* (L).

Differt a f. *fuliginoide* foliolis subrotundis vel oblongis, integris, emarginatis vel subcrenatis, 0.1—1 mm longis, sparsis vel confertis inter isidia.

Differing from f. *fuliginoides* by the presence of folioles in between the isidia. Folioles roundish or oblong, entire, emarginate or somewhat crenate, 0.1—1 mm long, scattered or more crowded.

Remarks. Among the brown *Parmeliae* several forms are known to have secondary folioles. They are *P. exasperatula* f. *sublaciniatula*, *P. laci-*

niatula, and *P. fuliginosa* var. *fuliginosa* f. *sublaciniosa*. From the two first-named, *P. subaurifera* f. *laciniata* may be told at once by its soralia and by its dark lower surface. As to the difference from *P. fuliginosa* var. *fuliginosa* f. *sublaciniosa* I may refer to f. *fuliginoides* where the main characteristics have been stated at some length.

Drente: Anlo-Zuidlaren, 3 V 1941, *Maas G. 759* (L); Ubbena, 4 V 1941, *Maas G. 803a* (L).

Overijsel: Diepenheim, 21 VII 1941, *Maas G. 1208* (L); Hellendoorn, 26 VII 1941, *Maas G. 1281* (L).

Gelderland: Hoevelaken, 27 V 1939, *Nannenga 822* (Nga).

Noord-Holland: Texel, Westermient, 14 V 1942, *Stafleu* (U).

Zuid-Holland: Ruigenhoek, 6 VII 1941, *Maas G. 1051*, type specimen (L).

Sectio 4. XANTHOPARMELIA Vain.

in Act. Soc. F. Fl. Fenn., vol. 7, 1890, pars 1, p. 60; A. Zahlbr. in Engler-Prantl, Die natürl. Pflanzenfam., vol. 1, pars 1*, 1907, p. 212 — *Parmelia* subgen. *Euparmelia* sect. *Xanthoparmelia* A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 120 et vol. 10, 1940, p. 503 (ubi lit.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 167.

Thallus foliaceous, growing in rosettes, loosely adhering to appressed. Lobes greenish yellow, more rarely grey-green. Lower surface pale or dark, rhizinose or at least with warts up to the tips of the lobes or with a narrow bare zone.

Remarks. Obviously, Zahlbruckner held the view that the subordination of sect. *Xanthoparmelia* to subgen. *Euparmelia* necessitated a new combination. This is an error. There is no article among the Rules of Botanical Nomenclature prescribing such a new combination on the ground of the intercalation of any subgeneric category. The section under discussion is neither changed in rank, nor transferred to another genus, and the same applies to the sections *Hypotrachyna* (p. 138) and *Amphigymnia* (p. 161).

In Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 127, *Parmelia centrifuga* is enumerated, though not without some hesitation, for as Van den Bosch puts it: "Species non visa ideoque et propter ambiguitatem dubia". As a matter of fact, *centrifuga* does not exist in Holland, being mainly a Scandinavian species.

Key to the species.

1a. Thallus small, soderiose. Lobes at most 1 mm broad . . . **17. P. mougeotii** Schaer.
1b. Thallus large, without soredia. Lobes about 2 mm broad, towards the tips still broader . . . . **16. P. conspersa** (Ehrh.) Ach.

16. Parmelia conspersa (Ehrh.) Ach., Meth. Lich., 1803, p. 205; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 127; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 125; vol. 8, 1932, p. 556 et vol. 10, 1940, p. 510 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 167 — *Lichen conspersus* Ehrh. in Ach., Lichenogr. Suec. Prodr., 1798, p. 118 — *Imbricaria conspersa* D.C. in Lam. et De Cand., Fl. Franç., ed. 3, vol. 2, 1805, p. 393; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 20.

Macroscopical description. Thallus foliaceous, up to 20 cm in diam. (usually much smaller in Holland), growing in rosettes and at least the peripherous lobes closely appressed, or irregularly wide-spreading with loosely adhering lobes, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, rather stiff, up to 2 or 3 cm long, 1—2 mm broad, flat at the tips and becoming more wavy towards the centre, more or less convex, or wavy altogether, discrete, contiguous, overlapping or entangled, richly and pinnately or irregularly branched. In some cases, the centre or the whole of the thallus is covered by small and narrow secondary lobes which grow in an irregular and entangled way over the main lobes. Margins flat, entire or irregularly crenate. Tips broadened, fan-shaped, up to 6 mm broad, broadly lobate to crenato-incised. Upper side of the lobes yellow-green, rarely grey-green, somewhat blackening towards the centre, usually partly black-rimmed, tanned at the very tips, shiny and smooth at the tips, dull and more or less wrinkled towards the centre, with occasional cortical ruptures, esorediate, either isidiate or without isidia. Isidia laminal, concolorous with the thallus, frequently with tanned apex, more or less scattered to closely packed, wart-like to cylindrical (isidia cylindrica), simple, furcate or branched and coralloid. Lower side of the lobes either black, turning darker or paler brown at the tips, or pale carneous brown, faintly shiny or dull, flat or somewhat canaliculate, smooth, rhizinose. Rhizinae numerous, black, simple or furcate, becoming small and wart-like towards the tips, sometimes leaving a narrow bare zone. *Microscopical description.* Upper cortex colourless, with a brown outer zone, paraplectenchymatous, 15—21 μ. Gonidia bright green, spherical, 6—15 μ, arranged in a layer of 30—65 μ. Medulla colourless, white in reflected light, sometimes with rusty stains, densely plectenchymatous, 90—120 μ, consisting of mesodermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 9—20 μ. *Apothecia* usually numerous, single or in small groups, laminal, sessile, at first cup-shaped, later on saucer-shaped, eventually irregularly wavy and torn, up to 8 mm in diam. Amphithecium concolorous with the thallus, sometimes turning brownish towards the base, dull, smooth or wrinkled. Margin entire or crenate, sometimes with a few isidia. Disc chestnut to dark brown, slightly shiny or dull, without pruina, smooth, ultimately folded. Epithecium brown, hymenium colourless, hypothecium colourless, with a gonidial layer beneath. Hymenium 30—45 μ. Asci cylindrical or clavate, 6—12 × 27—35 μ, octosporous. Spores rare, colourless, ellipsoidal, ovoid or bean-shaped, 5—6 × 8—11 μ. Paraphyses rather thick, septate, simple, conglutinate. *Pycnidia* usually abundant, visible as black dots, laminal, spherical or pyriform, 100—200 μ in diam. Perifulcrium colourless, ostiolum dark brown. Pycnoconidia colourless, cylindrical or somewhat fusiform, straight, ± 1 × 5—6 μ.

Chemical constituents and reactions. Upper cortex K + yellow, C —, KC + yellow, Pd + orange-brown. Medulla K — or +, either persistently yellow, or slowly or quickly turning red-brown, C —, KC — or + yellowish brown, Pd + yellow, then orange. Zopf (Flechtenstoffe, 1907, p. 107, 191, 416) mentioned the presence of d. usnic acid ($C_{18}H_{16}O_7$) and salazic acid ($C_{19}H_{14}O_{10}$). Hesse (in Journ. prakt. Chem., N. F., vol. 83, 1911, p. 81), on the other hand, never detected any trace of salazic acid, but found another compound ($C_{20}H_{16}O_{10}$) which he called conspersaic acid. Kusan in his important work on *Parmelia conspersa* (in Act. Bot. Inst. Bot. Univ. Zagreb., vol. 7, 1932, p. 1—34) also showed that there is no question about salazic acid, the acid investigated, though closely related to it, being rather more of the nature of saxatilic acid. According to the investigations by Asahina and Asano (in Ber. Deutsch. Chem. Ges., vol. 66 B, 1933, p. 689—699), the formula of salazic acid is $C_{18}H_{12}O_{10}$. Later on, Asahina and Fuzikawa (ibidem, vol. 68 B, 1935, p. 946—947) admonish to some caution in taking over the name salazic acid as used by the earlier authors, since α-methylether salazic acid ($C_{19}H_{14}O_{10}$) and norstictic acid ($C_{18}H_{12}O_9$) react in the same way upon K, giving similar red crystalline needles. Strangely enough, Keane, Mohan, and Nolan (in Sci. Proc. Roy. Dublin Soc., N. S., vol. 21, 1937, p.593—594), investigating material of *P. conspersa* from Howth (Ireland), find still another constituent, viz. stictic acid ($C_{19}H_{14}O_9$).

Distribution. The species is widely distributed throughout Europe.

Remarks. As already stated by Hillmann (l. c. p. 170), the variability of *Parmelia conspersa* is considerable. Translated, his observations read as follows: "The species varies, according to the habitat, in general appearance and size of the thallus. The lobes may be narrow or broad, long or short, they may be discrete, contiguous or imbricate, glabrous or isidiate. The colour of the lower side varies from carneous or pinkish brown to black. The reaction of the medulla upon reagents is variable, too". Only a few of the many varieties and forms described are represented in Holland.

There are very few species of yellow-green *Parmeliae* in Holland known to be saxicolous. Apart from *P. mougeotii* which has been met with only once, there is the possibility of finding *P. caperata* on boulders. This species, however, is easily distinguished from *conspersa* by its soralia, by the lower surface of its lobes which show a broad glabrous zone at the tips, and by the tips themselves which are broadly rounded.

Key to the varieties.

1a. Thallus isidiate 2
  2a. Isidia more or less scattered 3
    3a. Centre of the thallus composed of numerous, entangled, narrow, secondary laciniae . . . . var. **isidiosula** Hillm.
    3b. Thallus different; secondary laciniae, if present, not covering the whole of the thallus . . . . var. **conspersa** (Schaer.) Maas G.
  2b. Isidia closely packed, at least covering the centre of the thallus var. **isidiata** (Anzi) Stizenb.
1b. Thallus without isidia 4
  4a. Thallus growing in a rosette, more or less appressed, lobes contiguous or overlapping at the margins . . . . var. **conspersa** (Schaer.) Maas G.
  4b. Thallus irregularly wide-spreading, loosely adhering to the substratum, lobes entangled . . . . var. **stenophylla** Ach.

var. **conspersa** (Schaer.) Maas G. nov. comb. — *Parmelia centrifuga* var. *conspersa* Schaer., Lich. Helvet. Spicil., sect. 10, 1840, p. 472.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 22, fig. 1 (indistinct); Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 38 (poor); Schulz-Korth in Rep. spec. nov. regn. veg. Beih., vol. 67, 1931, tab. 2, fig. 2; Smith et Sowerb., Engl. Bot., vol. 30, 1810, tab. 2097; A. Zahlbr., in Engler-Prantl, Die natürl. Pflanzenfam., ed. 2, vol. 8, 1926, fig. 112B.

Thallus growing in rosettes, closely appressed. Lobes contiguous or overlapping at the margins. Not infrequently, there appear in older stages small, narrow, secondary lobes in the centre of the thallus which grow in an irregular and entangled way over the main lobes without, however, completely covering them. Lobes either with or without isidia, isidia somewhat crowded in the centre of the thallus.

Chemical reactions. Medulla K + yellow, slowly or quickly turning red-brown, KC — or + yellowish.

Ecology and frequency. Saxicolous, on siliceous boulders or on roofing tiles, rare, except on the granitic erratic blocks of the cairns (cf. p. 22) in the province of Drente, and occasionally on the boulders along the coast of the IJselmeer.

Remarks. I consider this variety identical with the type of *Parmelia conspersa.*

At the bottom of p. 171, Hillmann (l. c.) observes: "Die isidienlose Pflanze kann nicht gut als *Parmelia conspersa* bezeichnet werden, da Acharius in seiner Beschreibung das Vorhandensein von Isidien (pulvinuli) hervorhebt. — Nur ganz junge Pflanzen der Stammform haben glatte Oberfläche; siehe S. 16!" To be exact, the original description runs like this: "thallo ... glabro ...", and a few lines later Acharius remarks: "non raro pulvinulis ramulosis confluentibus maximam partem obtectus est hujus Lichenis thallus, praecipue versus centrum". This makes a difference; so, var. *conspersa* apparently may be devoid of isidia right enough, and this is not necessarily due to the thalli being too young, as supposed by Hillmann. In fact, Gyelnik (in Ann. Hist.-Natur. Mus. Nation. Hungar., pars bot., vol. 30, 1936, p. 120), who studied the Acharian types of *Parmelia conspersa* in Helsinki, stated that there are isidiate specimens as well as such devoid of isidia. It is presumably at very densely isidiate plants (later on called var. *isidiata* by Anzi) that Acharius hinted when writing "non raro pulvinulis ramulosis confluentibus maximam partem obtectus...". The Rijksherbarium possesses several specimens resembling in every way the genuine *conspersa.* Though they are destitute of isidia, they are unquestionably no young plants, for they attain about half the size of a hand.

Most of the specimens cited below are more or less transitional between var. *conspersa* and var. *isidiosula.*

Groningen: Bierum, Nansum, 14 VIII 1856 (Gro).

Drente: Angelsloo, 15 VII 1939, *Van Ooststroom & Zaneveld 7493* (L); *Van Ooststroom & Zaneveld 7499,* c. ap. (L); Balloo, 18 VII 1939, *Van Ooststroom & Zaneveld 7490* (L); Borger, 2 VIII 1837, *Van Hall,* c. ap. (L); 1849, *Van den Bosch,* c. ap. (NBV); X 1857 (Gro); Bronneger, 6 V 1941, *Maas G. 988,* c. ap. (L); Buinen, 17 VII 1939, *Van Ooststroom & Zaneveld 7491, 7498,* c. ap. (L); Diever, 2 VIII 1941, *Maas G. 1499* (L); Drouwen, 6 V 1941, *Maas G. 937* c. ap. (L); Emmen, 15 VII 1939, *Van Ooststroom & Zaneveld 7492* (L); Emmen-Odoorn, 16 VII 1939, *Van Ooststroom & Zaneveld 7502* (L); Emmerveld, 16 VII 1939, *Van Ooststroom & Zaneveld 7496, 7500,* c. ap. (L); Exloo, 17 VII 1939, *Van Ooststroom & Zaneveld 7501* (L); Gieten, 3 V 1941, *Maas G. 782* (L); Midlaren, 5 V 1941, *Maas G. 904, 908, 917* (L); Noordsleen, 9 V

1941, *Maas G. 1112*, c. ap. (L); *Maas G. 1116* (L); Rolde, V 1845 (L); Schoonoord, 17 VII 1939, *Van Ooststroom & Zaneveld 7495*, c. ap. (L); Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld 7494, 7503* (L); Valtherveld, 7 V 1941, *Maas G. 1015, 1054*, c. ap. (L).

Overijsel: Oldenzaal, *Buse & Buse-Koppiers*, c. ap. (L).

Gelderland: Hoef, 25 X 1941, *Maas G. 1616* (L); Groesbeek, 7 III 1941, *Maas G. 492* (L); Nijkerk, 28 XII 1920, *Keyzer & Florschütz* (U); 29 III 1936, *Nannenga 1231b* (Nga); Putten, 26 III 1921, *Ten Kate*, c. ap. (L).

var. **isidiata** (Anzi) Stizenb. in Ber. Tätigk. St Gall. Naturwiss. Ges., (1880/1881) 1882, p. 307; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 171; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 512 (ubi lit. et synon.) — *Imbricaria conspersa* var. *isidiata* Anzi, Cat. Lich. Sondr., 1860, p. 28 (non vidi) — *Parmelia conspersa* f. *isidiata*; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 130 (ubi lit. et synon.).

Thallus densely isidiose, at least in the centre. Isidia form a continuous or areolate cushion, not infrequently spreading over the greater part of the thallus, only leaving free the peripherical lobes.

Chemical reactions. Similar to those of var. *conspersa*.

Remarks. Under the synonyms of var. *isidiata* Zahlbruckner (l. c.) also mentioned *Parmelia conspersa* var. *laxa* f. *isidiigera* Müll. Arg. (erroneously assigned to var. *polyphylloides*) which was afterwards considered a separate species by Gyelnik (in Ann. Hist.-Natur. Mus. Nation. Hungar., pars bot., vol. 29, 1935, p. 27). This author found its medulla to react upon KC with a red colour, contrary to that of "*Parmelia isidiata*" (= *P. conspersa* var. *isidiata*) which shows a negative reaction (in Rep. spec. nov. regn. veg., vol. 29, 1931, p. 153). Now, Kusan (in Act. Bot. Inst. Bot. Univ. Zagreb., vol. 7, 1932, p. 17) demonstrated that (in *Parmelia lusitana* Nyl. = *P. conspersa* var. *lusitana* [Nyl.] Lett. = *P. conspersa* var. *verrucigera* f. *lusitana* [Nyl.] Kusan) the colouration of the medulla evoked by K is bleached by subsequent application of C. Apparently, Kusan attributed no value to this KC-reaction, for he made no further mention of it when describing the Yugoslavian varieties and forms of *conspersa*. Similarly, I found a negative reaction when the medulla of var. *isidiata* was treated with KC. Yet, it may be observed that the degree of bleaching depends on the equality of KOH and $CaCl_2O_2$ used. If, for instance, KOH is in excess, the medulla retains a yellowish colour.

To my surprise, I noticed a decided acceleration of the reaction, resulting in an intense red-brown colour if the medulla was first treated with C, and K was added afterwards!

Drente: Anloo, 3 V 1941, *Maas G. 744* (L).

Gelderland: Nijkerk, 29 III 1936, *Nannenga 1231a* (Nga).

var. **isidiosula** Hillm. in Verh. Bot. Ver. Prov. Brandenburg, vol. 65, 1923, p. 65 et in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 172; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 512.

Thallus especially in the centre consisting of numerous, very small and narrow, overlapping, secondary laciniae which are simple or branched, and more or less isidiate. Lower surface black or dark brown.

Remarks. Transitions to var. *conspersa* are numerous, in Holland at least they are in the majority.

Drente: Borger, VIII 1889, *Top*, c. ap. (L); Diever, 20 VII 1939, *Van Ooststroom & Zaneveld*, c. ap. (L); Rolde, V 1849, *Van den Bosch* (L, NBV).

var. **stenophylla** Ach., Meth. Lich., 1803, p. 206; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 173; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 513 (ubi lit. et synon.) — *Parmelia molliuscula* Ach.; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 71 et vol. 8, 1932, p. 562 (pro parte; ubi lit. et synon.).

Thallus not growing in a rosette, more or less irregularly widespreading, loosely adhering to the substratum. Lobes narrow, entangled, overlapping or imbricate, in the centre sometimes completely covered up by numerous, very narrow, entangled laciniae, devoid of isidia. Lower side varying from carneous, pale violet-brown, red-brown, dark brown to black.

Chemical reaction. Not different from those in var. *conspersa.*

var. **stenophylla** f. **georgiana** Ach., Synops. Lich., 1814, p. 209 — *Parmelia conspersa* var. *georgiana* Ach., Lichenogr. Univ., 1810, p. 487.

Iconography: Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 3, fig. 2.

Lobes up to 3 or 4 cm long, 1—3 mm broad, broadening up to 6 mm towards the tips, overlapping or entangled. Lower side dark brown to black.

Remarks. *Georgiana* is the oldest subdivisional epithet synonymous with var. *stenophylla,* and, going by the description Gyelnik gave of it (in Ann. Hist.-Natur. Mus. Nation. Hungar., pars bot., vol. 30, 1936, p. 122), I consider it identical with the type of this variety. This author stated of the Acharian originals: "Sie sind ganz ähnlich der hier besprochenen Var. *stenophylla,* nur sind die Abschnitte schwarz gesäumt, u. zwar nur an den Spitzen...". As black-rimmed lobes often occur in *P. conspersa,* I do not think their presence even suffices to base a separate form upon.

Most Scandinavian authors concur in considering *stenophylla* a species of its own. The differences from *conspersa* may be borrowed from Lynge (Studies on the Lichen Flora of Norway, in Vidensk. Selsk. Skr., vol. 1, Mat.-Naturvidensk. Kl., 1921, no. 7, p. 151): "*Parmelia stenophylla* is larger than *Parmelia conspersa,* it is more loosely affixed to the substratum, and it has narrower, longer, and more imbricate laciniae. There are no isidia, but small marginal secondary laciniae are not rare".

As to the latter, it may be easily verified that secondary laciniae are common to typical var. *conspersa* as well. Furthermore, we have seen that the absence of isidia is by no means restricted to *stenophylla.* To be sure, *conspersa* is characterised by its habit of growing in rosettes, whereas *stenophylla* is more irregularly wide-spreading with entangled and imbricate lobes. On the other hand, when purposely looking through the collection of the Rijksherbarium, I found some specimens of *conspersa* with imbricate central lobes. Hillmann, after having revised a part of our material of *Parmelia,* wrote à propos of an uncertain determination: "Es gibt Formen von *stenophylla,* die etwas rosettig wachsen, sie bilden habituelle Uebergänge zu *conspersa.* Andererseits sind auch bei guter *conspersa* die Rosetten manchmal aufgelöst". All these instances indicate the presence of stages transitional between both extremes. The finest example I could wish of an intermediate stage, however, is a specimen collected at the "Krockenfelsen bei Geroldsau", 1818 feet altitude, 14 VII 1859, in Körber's herbarium.

It is clearly *stenophylla*, irregularly wide-spreading, with imbricate lobes and a profusion of narrow secondary laciniae growing over the main ones. Both of them are sparingly beset with rather long, branched isidia! Would not all of this suffice to demonstrate that there is no specific difference between *conspersa* and *stenophylla*? Who would ever think of separating e. g. *Parmelia physodes* var. *physodes* f. *vittatoides*, and var. *subcrustacea* as two different species? Nobody would, for though the extremes are like poles asunder, a continuous chain of transitional stages indicates that all varieties and their forms belong to one and the same species. Why, then, make an exception for the case *conspersa* — *stenophylla*?

Finally, there is the question of the chemical reaction of the medulla upon K. Lynge (l. c.) writes: "There is a certain correlation between the morphological and the chemical difference. *P. stenophylla*... nearly always gave a distinct red colour with KOH, *P. conspersa* a more irregular reaction: a few specimens a purely yellow colour, the greater part an intermediate, orange colour, and some specimens an intensely red colour". Now, this is what I found with our material of *stenophylla* which fully corresponds with the descriptions by Lynge and Hillmann, as well as with a specimen collected by Du Rietz. A medullary reaction which turned from yellow to chestnut or brown-red was found in material from Austria (1 ×), Corsica (1 ×), France (4 ×), Germany (6 ×), Russia (1 ×), Sweden (1 ×), and Switzerland (2 ×). A reaction shifting from yellow to yellow-brown was shown in specimens from France (1 ×) and Hungary (1 ×). An intensely red colour was never found.

As far as a conclusion is allowed to be drawn from these results, there is no indication whatever of a conspicuous difference between *conspersa* and *stenophylla* in chemical respect either.

Drente: Borger, V 1849, *Van den Bosch* (NBV).

Noord-Brabant: Breda (L); *Buse & Buse-Koppiers* (NBV); Teteringen, 1852, unio NBV (NBV).

17. **Parmelia mougeotii** Schaer. in Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, p. 118; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 142; vol. 8, 1932, p. 562 et vol. 10, 1940, p. 526 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 179.

Macroscopical description. Thallus foliaceous or almost crustaceous, minute, 0.5—1 cm in diam., either growing in rosettes or not, closely appressed, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, about 2 mm long, 0.2—0.5 mm broad, flat or somewhat convex, especially in the centre, contiguous or discrete, irregularly or pinnately branched. Margins flat, entire. Tips either broadened or not, rounded, emarginate or incised. Upper side of the lobes either yellow-green to grey-green, faintly shiny, with tanned tips, soon turning blackish green and becoming dull towards the centre of the thallus, or save for the yellow tips entirely dark grey to blackish, smooth or somewhat uneven, with cortical cracks, without isidia, sorediate. Soralia laminal, more or less scattered, maculiform, 0.4—0.8 mm across, at first blackish green and hemispherical, later on by abrasion showing the yellow-green soredia, and becoming more flattened. Lower side of the lobes black and dull in the centre, dark brown and faintly shiny at the tips, rhizinose up to the very tips. Rhizinae more or less numerous, black, short. *Microscopical description.* Upper cortex colourless or with a brownish exterior zone, paraplectenchymatous, 15—21 μ. Gonidia bright green, spherical 6—12 μ, arranged in a continuous layer of 30—60 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 30—90 μ, consisting of pachydermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 15—21 μ. *Apothecia* and *pycnidia* not seen.

Chemical constituents and reactions. Upper cortex K + yellowish, C —, KC + strongly yellow, Pd + orange-brown. Medulla K + persistently yellow or turning reddish, C —, KC —, Pd + orange. According to Zopf (Flechtenstoffe, 1907, p. 108, 416), this species contains d. usnic acid ($C_{18}H_{16}O_7$).

Ecology and frequency. Saxicolous, found once only.

Distribution. Remarkably enough, the species appears to be lacking in most countries of East Europe: Finland, U. S. S. R. and the Baltic republics, Hungary, Rumania, Bulgaria, Yugoslavia, Albania and Greece. They are too numerous for assuming that the species would have been overlooked. Only the absence of *P. mougeotii* in Spain could be explained this way, as the species occurs both in Portugal and France.

Remarks. Hillmann (l. c. p. 181) pointed out that the difference between *P. mougeotii* and the saxicolous forms of *Parmeliopsis ambigua* is in the different medullary reaction (which, by the way, does not hold for *P. mougeotii* f. *reagens*!), the spores and the pycnoconidia. Now, the chance of finding *P. mougeotii* in Holland for a second time seems slight, and saxicolous forms of *P. ambigua* have never been found yet, so that confusion is not to be feared. Nevertheless, it may be generally useful to know some more features by which to distinguish between both species, even if sterile. In *Parmeliopsis ambigua* the cortex is palisade plectenchymatous, and the lower cortex 9—12 μ thick, whereas in *P. mougeotii* the upper cortex is paraplectenchymatous, and the lower one 15—21 μ.

From *P. conspersa* this species is well separated by its smallness, and by its nearly black thallus dotted with yellow-green soralia.

f. **mougeotii** (Leight.) Maas G. nov. comb. — *Parmelia conspersa* f. *mougeotii* Leight., Lich. Fl. Great Brit., 1871, p. 136 (non vidi) et ed. 3, 1879, p. 125.

Iconography: Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 288, fig. inf.; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 22, fig. 3; Schulz-Korth in Rep. spec. nov. regn. veg. Beih., vol. 67, 1931, tab. 2, fig. 3.

Thallus foliaceous, growing in rosettes. Lobes contiguous. Upper side yellow-green or grey-green, turning blackish in the centre of the thallus. Medulla K + yellow.

Remarks. I consider this form to agree with the type of *Parmelia mougeotii*.

As regards the choice of this subdivisional epithet, some explanation may be useful. Zahlbruckner (Cat. Lich. Univ., vol. 6, 1929, p. 143) mentions two older synonyms, the first one being *Imbricaria conspersa* var. *stenomicrophylla* f. *soreumatica* Flot. (in Flora, vol. 11, 1828, p. 724). To begin with, this quotation is wrong. In that place Von Flotow stated that he could not find any constant difference between *P. caperata* and *P. conspersa,* the width of the lobes varying gradually, and that he had recently found a specimen of *P. conspersa* whoseserediate lobes were still narrower. If this may suffice for a description, a varietal epithet at any rate was not supplied. Later on (in Jahresber. Schles. Ges. vaterl. Kult., vol. 28, 1850, p. 134), Von Flotow cited as a synonym to *Imbricaria mougeotii* Schaer. his *I. conspersa, steno-microphylla soreumatica* Fw., referring to his herbarium and to Flora 1828, p. 724. Again, this is not a subdivisional epithet, but suggests a sort of phrase-name; a varietal name was denoted this way "*I. sinuosa β revoluta* Fw." (l. c. p. 129).

The second synonym is Körber's *Imbricaria diffusa* f. *saxicola* which was published in his Syst. Lich. German., 1855, p. 83. The author, however, was not sure of this form being identical with Schaerer's type specimen, and he returned on his way after having seen the genuine *P. mougeotii* (Parerg. Lichenol., 1865, p. 32). In fact, the two examples of *Imbricaria diffusa* f. *saxicola* in Körber's "Stammherbar", preserved in the Rijksherbarium, are clearly saxicolous *Parmeliopsis ambigua.* Therefore, f. *saxicola* is synonymous with that species.

P. mougeotii f. *mougeotii* was in Holland found in small quantity on a fragment of a schistose slab which had been used as a covering of a concrete casemate dating from the first world war. Now, slate-stone, though occurring in this country, is never found in that quality as used in the casemate under discussion. It has certainly been imported, and it is quite probable that *Parmelia mougeotii* has been imported along with the stone. If so, it must be observed that the specimens have held out for at least 25 years, and were still thriving well when collected.

Utrecht: Odijk, 20 II 1942, *Stafleu* (U).

Sectio 5. HYPOTRACHYNA Vain.

in Act. Soc. F. Fl. Fenn., vol. 7, 1890, pars 1, p. 38; A. Zahlbr. in Engler-Prantl, Die natürl. Pflanzenfam., vol. 1, pars 1*, 1907, p. 212 — *Parmelia* subgen. *Euparmelia* sect. *Hypotrachyna* A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 149 et vol. 10, 1940, p. 503 (ubi lit.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 187.

Thallus foliaceous, growing in rosettes or wide-spreading, more or less appressed. Upper side of the lobes pale grey, bluish grey, grey-green, rarely dark brown (in a species not indigenous to Holland). Lower side rhizinose up to the tips of the lobes, or with rhizinae passing into wart-like papillae, or with a narrow bare zone at the tips of the lobes. *Apothecia* sessile or shortly pedicellate.

Remarks. Vainio divided this section into three subsequent subsections, but as it is not always easy to assign a species to any of them, Hillmann dropped this subdivision, and so has been done here.

Key to the species.

1a. Thallus esorediate and without isidia 2

2a. Lobes, be it faintly, reticulately dented and pseudocyphellate. Medulla Pd + yellow, then turning orange, C —
some forms of 23. P. sulcata Tayl.

2b. Lobes not reticulately dented, without pseudocyphellae. Medulla Pd — or + yellowish, C + red . . . . **18. P. quercina** (Willd.) Vain.

1b. Thallus isidiate or sorediate 3

3a. Thallus isidiate 4

4a. Lobes reticulately dented, pseudocyphellate. Medulla Pd + yellow, turning orange, C — . . . . **19. P. saxatilis** (L.) Ach.

4b. Thallus not reticulately dented, without pseudocyphellae. Medulla Pd + yellowish, C + red . . . . **20. P. scortea** Ach.

3b. Thallus sorediate 5

5a. Lobes beneath pale brown or whitish. Medulla Pd —, C + red **21. P. dubia** (Wulf.) Schaer.

5b. Lobes beneath black, turning dark brown towards the tips of the lobes 6

6a. Medulla C + pink or red . . . . . . **22. P. revoluta** Flk.

6b. Medulla C — 7

7a. Lobes pseudocyphellate. Soralia scattered all over the thallus, fissure-shaped . . . . **23. P. sulcata** Tayl.

7b. Lobes without pseudocyphellae. Soralia subterminal (**26. P. trichotera** Hue)

18. Parmelia quercina (Willd.) Vain. in Termész. Füzetek, vol. 22, 1899, p. 279 (non vidi); A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 186 et vol. 10, 1940, p. 531 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 188 — *Lichen quercinus* Willd., Fl. Berol. Prodr., 1787, p. 353 (non vidi) — *Parmelia tiliacea* Ach., Meth. Lich., 1803, p. 215; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 124 — *Imbricaria tiliacea* Körb., Lichenogr. German. Specim., 1846, p. 9 (non vidi); Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 16.

Macroscopical description. Thallus foliaceous, up to about 8 cm in diam., growing in rosettes, more or less appressed, attached to the substratum by means of rhizinae, deeply incised; in the case of var. *erratica* (not indigenous), the minute thallus is balled into a sphere and not attached to the substratum at all. Lobes dorsiventrally flattened, in some cases very small, 0.5—1 mm long and equally broad, but usually much larger, 3—4 cm long, 3—5 mm broad, flat, convex or somewhat wavy, sometimes folded in the centre of the thallus, contiguous, overlapping or imbricate, irregularly or pinnately branched. Margins flat, entire or irregularly crenate. Tips more or less appressed, more rarely revolute, more or less broadened, up to 6—8 mm broad, entire and broadly rounded, or crenate, lobate or incised. Upper side of the lobes varying from pale grey, ash-grey, brownish grey to blackish grey, darker in the centre of the thallus, with a narrow black rim along the margins, with or without pruina, dull or slightly shiny, smooth to strongly wrinkled, with occasional cortical cracks, without soredia or isidia. Lower side of the lobes black in the centre, dark brown at the tips, dull, densely rhizinose up to the very tips. Rhizinae black, long, simple or furcate. *Microscopical description.* Upper cortex colourless, with a brownish outer zone, paraplectenchymatous, 15—28 μ. Gonidia bright green, spherical, 9—14 μ, arranged in a continuous layer of 30—50 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 50—120 μ, consisting of pachydermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 10—15 μ. *Apothecia* usually numerous, sometimes crowded, laminal, sessile, saucer-shaped, up to 4 or 5 mm in diam. Amphithecium concolorous with the lighter part of the upper side, dull, smooth. Margin persistent, entire or crenate. Disc chestnut, shiny, without pruina, smooth. Epithecium yellow-brown, hymenium colourless, hypothecium colourless or yellowish, with a gonidial layer underneath. Hymenium 50—75 μ. Asci slender and cylindrical or somewhat clavate, 9—15 × 40—60 μ, 8-spored. Spores colourless, ellipsoidal, thick-walled, 1-celled, though the inner cell-wall is frequently constricted, making the contents of the spores look like dumb-bells, 6—7 × 9—11 μ. Paraphyses septate, simple or furcate, with incrassate apex. *Pycnidia* laminal, visible as black dots, pyriform or lenticular, 100—200 μ in diam. Perifulcrium brownish, ostiolum dark brown. Pycnoconidia colourless, cylindrical, straight, ± 1 × 6—8 μ.

Chemical constituents and reactions. Upper cortex K + yellow, C —, KC + red-brown, Pd + yellowish. Medulla K —, C + red, KC + red, Pd — or + yellowish. As pointed out by Zopf (Flechtenstoffe, 1907, p. 225, 418), this species contains lecanoric acid ($C_{16}H_{14}O_7$), and atranorin ($C_{19}H_{18}O_8$), the former being responsible for the red reaction of the medulla when treated with C, the latter for the upper cortex being stained yellow with K.

Distribution. Little definite knowledge about the distribution of this species is to be gained from the literature. As stated by Hillmann (l. c. p. 190): "Aus der Literatur lässt sich über das Areal der *Parmelia quercina* keine Vorstellung gewinnen, da die Art früher meist mit *Parmelia scortea* zusammengefasst bzw. verwechselt worden ist. Es hat den Anschein, als ob *quercina* im Gebiete keineswegs häufig ist". According to this author, *P. quercina* appears to be unknown from the lowlands of North-West Germany which is in keeping with the fact that the species is lacking in Holland to-day. On the other hand, several finds have been recorded from various provinces of the country in the middle of the previous century and in the beginning of the present one.

Key to the varieties.

1a. Apothecia well developed . . . . var. **arborea** (Weis) Maas G.
1b. Thallus with numerous abortive apothecia var. **feracissima** (Müll. Arg.) Hillm.

var. **arborea** (Weis) Maas G. nov. comb. — *Lichen laciniatus* var. *arboreus* Weis, Pl. Cryptog. Fl. Gotting., 1770, p. 56.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 22, fig. 8; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 30; Fée, Essai Cryptog. Ecorc. Offic., 1824, tab. 2, fig. 13; Fink in Contrib. Unit. States Nation. Herb., vol. 14, pars 1, 1910, tab. 36, fig. A; Lynge in Bergens Mus. Aarb., 1910, no. 9, tab. 5, fig. 5; Wulf. in Jacquin, Collect. Bot., vol. 3, 1789, tab. 9, fig. 2 (at least left hand specimen).

Thallus medium-sized to large. Lobes 3—4 cm long, 3—5 mm broad, flat or somewhat wavy, contiguous or overlapping at the margins, with more or less appressed tip. Upper side in various shades of grey, not blackish, epruinose, smooth, becoming uneven or somewhat wrinkled in the centre of the thallus. *Apothecia* well developed, fertile.

Ecology and frequency. On deciduous trees, no recent finds are known.

Remarks. I consider this variety to correspond with the type of *Lichen quercinus.*

Groningen: Groningen-Essen, 10 I 1853 (Gro); Haren, Harendermolen, *Acker Stratingh* (Gro).
Overijsel: Kampen, *Top*, c. ap. (NBV).
Gelderland: Doorwerth, 1840, *Buse* (NBV); Renkum, *Buse*, c. ap. (L); VIII 1840, *Buse & Gildemeester-Buse*, c. ap. (NBV).
Utrecht: Leersum, Darthuizen, 9 VI 1839, *Van Hall*, c. ap. (Gro).
Noord-Brabant: 's Hertogenbosch-Helvoirt, 25 X 1905, *Wakker*, c. ap. (L); Vught, 25 V 1903, *Wakker*, c. ap. (L).
Limburg: Maastricht, *Franquinet* (Maastr).

var. **feracissima** (Müll.-Arg.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 193; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 532 — *Parmelia tiliacea* var. *feracissima* Müll.-Arg. in Flora, vol. 69, 1886, p. 256.

Centre of the thallus covered with numerous abortive apothecia which are about 0.5 mm across.

Gelderland: Renkum, VIII 1840, *Buse & Gildemeester-Buse*, c. ap. (NBV).

19. Parmelia saxatilis (L.) Ach., Meth. Lich., 1803, p. 204; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 124; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 198; vol. 8, 1932, p. 566 et vol. 10, 1940, p. 533 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 207 — *Lichen saxatilis* L., Spec. Pl., vol. 2, 1753, p. 1142 — *Imbricaria saxatilis* Körb., Lichenogr. German. Specim., 1846, p. 9 (non vidi); Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 17.

Most of the material cited under *Parmelia saxatilis* (by Van den Bosch, l. c.) or under *Imbricaria saxatilis* (by Abeleven, l. c.) in reality belong to *P. sulcata.*

Macroscopical description. Thallus foliaceous, medium-sized to large, up to 20 cm in diam. (usually smaller in Holland), growing in rosettes or irregularly wide-spreading, more or less loosely adhering to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, greatly variable, 0.5—10 cm long, 0.2—4 mm broad, more or less strongly wavy or even twisted, contiguous, overlapping or imbricate, irregularly branched. Margins flat or strongly raised, entire, somewhat crenate or isidiate. Tips broadened, fan-shaped, up to 6—10 mm broad, flat or raised, rounded, crenate or incised. Upper side of the lobes ash-grey or bluish grey, darker in the centre of the thallus, with or without pruina, dull, with tanned and slightly shiny tips, almost smooth to more or less deeply reticulately indented, pseudocyphellate, without isidia or densely isidiate. Pseudocyphellae white, of irregular form, mainly occurring on the ridges bordering the dents, towards the centre of the thallus frequently replaced by isidia. Isidia concolorous with the thallus, usually with tanned apices or blackish brown all over, laminal or marginal, scattered to densely crowded, ranging from warts to slender, cylindrical outgrowths (isidia cylindrica), simple or furcate to branched and coralloid. Lower side of the lobes black in the centre of the thallus, brown at the tips, more or less shiny, smooth or somewhat wrinkled, densely rhizinose. Rhizinae black, long, simple or furcate, sometimes protruding from the lobes, reaching up to the tips of the lobes or passing into warts. *Microscopical description.* Upper cortex colourless or yellowish, with brownish exterior zone, paraplectenchymatous, 18—25 μ. Gonidia bright green, spherical, 6—12 μ, arranged in clusters or in a continuous layer of 20—40 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 60—100 μ, consisting of leptodermatous hyphae. Lower cortex black-brown, paraplectenchymatous, 12—20 μ. *Apothecia* very rare, not found in the present time, laminal, sessile or with constricted base, at first cup-shaped, later on saucer-shaped, up to 5 mm in diam. Amphithecium of the same colour as the thallus or somewhat tanned, dull, smooth or somewhat wrinkled. Margin persistent, isidiate. Disc light to dark red-brown, without pruina, dull or faintly shiny, smooth, flat, later irregularly wavy. Epithecium brownish, hymenium colourless, hypothecium yellowish brown, with a gonidial layer underneath. Hymenium 90—150 μ. Asci cylindrical to clavate, 15—24 × 60—70 μ, octosporous. Spores colourless, ellipsoidal, thick-walled, 10—13 × 15—18 μ. Paraphyses septate, unbranched, conglutinate. *Pycnides* not observed.

Chemical constituents and reactions. Upper cortex K + yellowish, C —, KC + yellowish, Pd + yellowish. Medulla K + yellow, then turning red-brown, C —, KC + red-brown, Pd + yellow, changing into orange. Zopf (Flechtenstoffe, 1907, p. 208, 225, 275, 417) states the presence of the bitter saxatilic acid ($C_{19}H_{14}O_{10}$), atranorin ($C_{19}H_{18}O_8$), and lobaric acid ($C_{24}H_{26}O_8$). According to the investigation by Asahina and Tanase (Ber. Deutsch. Chem. Ges., vol. 67B, 1934, p. 1434—1435) on Japanese *Parmelia saxatilis,* saxatilic acid must be considered identical with salazic acid ($C_{18}H_{12}O_{10}$). Asahina and Nonomura (Ber. Deutsch. Chem. Ges., vol. 68B, 1935, p. 1698—1704) examined several lichens containing lobaric acid, and found the formula $C_{25}H_{28}O_8$ to be more in accordance with the properties of this acid than that proposed by Zopf.

Distribution. The species is widely distributed all over Europe.

Remarks. A fair number of varieties and forms have been described of *Parmelia saxatilis,* and some of them also occur in Holland. The variability in this country affects the number of the isidia, the presence or absence of secondary laciniae or of a pruina on the upper surface of the lobes, and the general appearance of the lobes themselves.

Key to the varieties and forms.

1a. Upper side of the lobes more or less caesio-pruinose var. **saxatilis** (Weis) Maas G. f. **pruinosa** Lynge
1b. Lobes epruinose 2
  2a. Lobes short and very narrow, 0.2—1 mm broad, richly branched, imbricate var. **microphylla** (Harm.) Erichs.
  2b. Lobes for the greater part longer and broader 3
    3a. Thallus without secondary laciniae 4
      4a. Isidia more or less scattered var. **saxatilis** (Weis) Maas G. f. **furfuracea** Schaer.
      4b. Isidia crowded, covering the whole of the thallus except a narrow peripheral zone . . . . . var. **aizoni** Del. f. **eu-aizoni** Maas G.
    3b. Thallus with secondary laciniae interspersed in between the isidia var. **laciniata** Erichs.

var. **saxatilis** (Weis) Maas G. nov. comb. — *Lichen laciniatus* var. *saxatilis* Weis, Pl. Cryptog. Fl. Gotting., 1770, p. 55.

Lobes contiguous or overlapping, with or without isidia. Isidia concolorous with the thallus or with tanned apices, cylindrical.

Remarks. Var. *saxatilis* comprises a group of forms, including "f. typica" itself, deviating only in minor respects from the type. To replace this f. typica, there exists an older subdivisional epithet, viz. *Parmelia saxatilis* var. *leucochroa* f. *munda* Schaer. (Lich. Helvet. Spicil., sect. 10, 1840, p. 455). This is a nomen nudum, to be sure, but in his Enum. Crit. Lich. Europ., 1850, p. 45, Schaerer validly published this form, describing it as "thallo supra mundo" with reference to his exsiccatum no. 362. In two of the three exsiccata of this number in possession of the Rijksherbarium, the thallus appears to be nude except for a few laminal or marginal isidia in the centre of the thallus. In order to compare the exsiccata with the authentic Linnean material, Mr Savage, Librarian and Assistant Secretary of the Linnean Society of London, kindly sent me two photographs. One is showing 4 specimens of *Lichen saxatilis* glued to a sheet, whereas the other is an enlarged reproduction of the plant at the bottom of the sheet which enables the specimen being studied more closely. In this specimen, too, a few short isidia are scattered over the surface. Thus, in accordance with the views held by Zahlbruckner (Cat. Lich. Univ., vol. 6, 1929, p. 203) and by Hillmann (l. c. p. 210), I consider Schaerer's f. *munda* to agree with the Linnean type. For the iconography I may refer to Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 23, fig. 1; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 29; Smith et Sowerb., Engl. Bot., vol. 9, 1799, tab. 603.

As yet, no finds of this form have been recorded from Holland, all specimens found being more densely isidiate.

var. **saxatilis** f. **furfuracea** Schaer., Enum. Crit. Lich. Europ., 1850, p. 45 — *Parmelia saxatilis* f. *furfuracea* Linds. in Trans. Roy. Soc. Edinburgh, vol. 22, 1859, p. 227; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 125; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 211; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 533 — *Imbricaria saxatilis* f. *furfuracea* Arn. in Flora, vol. 67, 1884, p. 161; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 17 — *Parmelia saxatilis* var. *aizoni* Del.; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 205 (pro parte!; ubi lit. et synon.).

Iconography: presumably, Schulz-Korth in Rep. spec. nov. regn. veg. Beih., vol. 67, 1931, tab. 20, fig. 38, 39 belong here.

Thallus isidiate. Isidia more or less numerous, varying from short warts to long cylindrical outgrowths.

Ecology and frequency. On boulders and deciduous trees (mainly oak and beech, sometimes also birch, poplar and elm), usually occurring at the base of the trees where conditions of humidity are best realised. This is the most common form in Holland, sometimes approaching var. *aizoni* in that the thallus is more densely isidiate.

Remarks. It may be observed that the lobes in specimens from sheltered places are almost smooth and little pseudocyphellate, while those being more exposed to sun or wind or both are deeply indented and markedly pseudocyphellate.

Groningen: Ter Apel, 6 I, 6 VII 1907, Tresling (TA).

Drente: Anloo, 3 V 1941, *Maas G. 743*, transition to var. *laciniata* (L); Borger, *Van den Bosch* (L, NBV); 2 VIII 1837, *Van Hall*, transition to var. *laciniata* (NBV); Emmen, 15 VII 1939, *Van Ooststroom & Zaneveld 7535*, transition to var. *laciniata* (L); Emmen, Emmerveld, 16 VII 1939, *Van Ooststroom & Zaneveld 7531* (L); 8 V 1941, *Maas G. 1079* (L); Frederiksoord, 1 XI 1942, *Van Rossem 512*, transition to var. *aizoni* f. *eu-aizoni* (L); Gieten, 3 V 1941, *Maas G. 784* (L); Midlaren, VII 1846, *Van Hall* (NBV); Noordsleen, 15 VII 1939, *Van Ooststroom & Zaneveld 7533* (L); *Van Ooststroom & Zaneveld 7534*, transition to var. *laciniata* (L); Schipborg, 3 V 1941, *Maas G. 766, 770* (L).

Overijsel: Goor, 25 VII 1941, *Maas G. 1275*, transition to var. *aizoni* f. *eu-aizoni* (L).

Gelderland: Doornspijk, 25 IV 1942, *Maas G. 1833* (L); Ellekom, De Steenkuilen, 14 VI 1943, *Maas G. 2584* (L); Ellekom, Hagenau, 13 VI 1943, *Maas G. 2534*, transition to var. *aizoni* f. *eu-aizoni* (L); Garderen, 3 I 1940, *Stafleu*, transition to var. *aizoni* f. *eu-aizoni* (U); Hierden, Hulshorst, 25 X 1941, *Maas G. 1590* (L); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2343* (L); *Maas G. 2355*, transition to var. *aizoni* f. *eu-aizoni* (L); Hoenderloo, Leesten-Uchelen, 27 III 1943, *Maas G. 2348*, transition to var. *aizoni* f. *eu-aizoni* (L); Kotten, Bekkendelle, 14 IV 1941, *Stafleu* (U); Leuvenum, Leuvenumsche bosch, 26 X 1941, *Maas G. 1672* (L); Nijkerk, 28 XII 1920, *Keyzer & Florschütz* (U); Oldebroek, 19 VIII 1942, Miss *Lusink* (L); Uchelen, 30 IV 1939, *Groot & Van Soest 118* (VS); Uddel, Uddelermeer, 1849, unio NBV, c. ap. (L); unio NBV, transition to var. *aizoni* f. *eu-aizoni* (NBV).

Utrecht: Baarn, Groeneveld, 7 II 1943, *Maas G. 2255, 2265* (L); Baarn, Soestdijk, I 1920, *Hart de Ruyter* (U); Doorn, 19 IV 1941, *Maas G. 684*, transition to var. *aizoni* f. *eu-aizoni* (L); Maartensdijk, Eyckestein-De Vuursche, 22 II 1941, *Stafleu* (U); De Vuursche, Lage Vuursche, 15 II 1941, *Nannenga 1107b* (Nga); De Vuursche-Hilversum, 28 II 1943, *Maas G. 2275* (L).

Zuid-Holland: 's Gravenhage, Haagsche bosch, *de Haan* (NBV); Wassenaar, Meiendel, 4 IV 1942, *Van Rossem 122* (L); 13 IX 1942, *Maas G. 2222* (L); Wassenaar, Duinrel, 24 X 1942, *Maas G. 2233*, transition to var. *aizoni* f. *eu-aizoni* (L).

Limburg: Eys, Eyser bosch, 7 VI 1947, *Barkman* (L); Mook, St Jansberg, 8 IV 1942, *Stafleu* (U).

var. **saxatilis** f. **pruinosa** Lynge in Bergens Mus. Aarb., 1910, no. 9, p. 91 — *Parmelia saxatilis* f. *pruinosa* (Lynge) A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 204 et vol. 10, 1940, p. 533; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 212.

Upper surface more or less caesio-pruinose and shortly isidiate.

Remarks. It should be noticed that Zahlbruckner (l. c. p. 204) erroneously considered his *P. saxatilis* f. *pruinosa* to be a new combination, since Lynge's *pruinosa*, though originally subordinated to var. *retiruga*, remains unaltered in its subdivisional rank, being a form of *P. saxatilis*, whichever variety be intercalated. The variety is used as a means of more easily localising the form within the species, but the Rules of Botanical Nomenclature do not prescribe a new combination if a form is transferred from one variety to another of the same species.

In Ann. Mycol., vol. 22, 1924, p. 222, Hilitzer described a f. *farinacea* which probably does not differ from f. *pruinosa*. It is true that Lynge in his description reported the presence of numerous short isidia, whereas Hilitzer stated that the isidia in f. *farinacea* were rare. In my opinion, however, it is the pruina which should be accentuated, rather than the number of the isidia which in *Parmelia saxatilis* is a somewhat fluctuating character.

Gelderland: Elspeet, Elspeeter bosch, 27 X 1941, *Maas G. 1720* (L).

var. **aizoni** Del. apud Duby in De Cand. et Duby, Bot. Gall., ed. 2, vol. 2, 1830, p. 602; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 205 et vol. 10, 1940, p. 533 (pro parte; ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 212.

Isidia concolorous with the thallus or dark brown to almost black, covering the greater part of the thallus, closely packed, forming a dense continuous or areolate cushion, only the peripheral lobes free from isidia.

var. **aizoni** f. **eu-aizoni** Maas G. nov. f.

Typus: the same as of *Parmelia saxatilis* var. *aizoni*.

Thallus isidiis concoloribus.

Isidia concolorous with the thallus, at most with tanned apices.

Ecology and frequency. This form occurs in the same places as f. *furfuracea*, but is much rarer. Transitions between both forms are known.

Drente: Ansen, 2 VIII 1941, *Maas G. 1522a* (L); Assen, 2 V 1941, *Maas G. 717a* (L); Eext, *Van der Sande Lacoste* (NBV); Noordsleen, 9 V 1941, *Maas G. 1113*, partly transition to var. *laciniata* (L); Noordsleen-Emmen, 13 XII 1940, *Maas G. 264* (L); Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld 7532* (L); 7 V 1941, *Maas G. 1060*, transition to var. *laciniata* (L).

Gelderland: Hierden, Hoophuizen, 24 X 1941, *Maas G. 1581* (L).

Zuid-Holland: 's Gravenhage, Haagsche bosch, VI 1889, *Top* (L).

var. **laciniata** Erichs. in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 16; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 566 et vol. 10, 1940, p. 534; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 213.

Isidia partly developing into simple, crenate or lobate secondary laciniae.

Drente: Ansen, 2 VIII 1941, *Maas G. 1522b* (L); Assen, 2 V 1941, *Maas G. 717b* (L); Drouwen, 6 V 1941, *Maas G. 935* (L); Eext, 3 V 1941, *Maas G. 732* (L); Emmen, 8 V 1941, *Maas G. 1087*, transition to var. *saxatilis* f. *furfuracea* (L); Emmen, Westenesch, 8 V 1941, *Maas G. 1092* (L).

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1144* (L); 20 VII 1941, *Maas G. 1163* (L).

Gelderland: Ede, 11 IV 1941, *Maas G. 640, 642* (L); Gelselaar, 20 VII 1941, *Maas G. 1165*, transition to var. *saxatilis* f. *furfuracea* (L); Hierden, Hulshorst, 24 X 1941, *Maas G. 1555* (L); Nijkerk, 29 III 1936, *Nannenga 1235* (Nga); Putten, Sollensche Gat, 30 XII 1941, *Stafleu* (U).

Utrecht: Maartensdijk, Eyckestein, 5 IV 1942, *Vervoort* (L).

Zuid-Holland: 's Gravenhage, Haagsche bosch, 15 VI 1941, *Maas G. 945* (L).

var. **microphylla** (Harm.) Erichs. in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 17; A. Zahlbr. Cat. Lich. Univ., vol. 8, 1932, p. 566 et vol. 10, 1940, p. 534; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 213 — *Parmelia saxatilis* var. *laevis* f. *microphylla* Harm. in Bull. Soc. Sci. Nancy, ser. 2, vol. 31, (1896) 1897, p. 225.

Some of the lobes, mainly the central ones, short and narrow, frequently less than 0.5 mm broad, imbricate.

Ecology. This variety has only been found on boulders of the cairns in the province of Drente, apparently a habitat similar to those mentioned by Erichsen (l. c.).

Remarks. Originally f. *microphylla* was described as a form with smooth thallus and no isidia, belonging to var. *laevis* Nyl. (= var. *saxatilis* f. *munda* Schaer.). Obviously, Erichsen considered the form and the size of the lobes to be more important than the presence or absence of the isidia, as he wrote: "Isidien spärlich oder zahlreicher...".

Drente: Anlo, 18 VII 1939, *Van Ooststroom & Zaneveld 7529, 7530* (L); Borger, VIII 1889, *Top* (NBV); Bronneger, 6 V 1941, *Maas G. 984* (L); Noordsleen, 9 V 1941, *Maas G. 1107* (L).

20. **Parmelia scortea** Ach., Meth. Lich., 1803, p. 215; A. Zahlbr., Cat. Lich. Uuiv., vol. 6, 1929, p. 207; vol. 8, 1932, p. 567 et vol. 10, 1940, p. 534 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 196 — *Lichen tiliaceus* Hoffm., Enum. Lich., 1784, p. 96 (non vidi) — *Lichen scorteus* Ach., Lichenogr. Suec. Prodr., 1798, p. 119 — *Imbricaria tiliacea* (Hoffm.) Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 16 — *Parmelia tiliacea* (Hoffm.) Vain. in Termész. Füzetek, vol. 22, 1899, p. 279 (non vidi); Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 124.

Macroscopical description. Thallus foliaceous, up to 8 cm in diam., growing in rosettes or wide-spreading, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, thick and stiff, 0.5—2 cm long, 2—5 mm broad, more or less strongly wavy, contiguous, overlapping or partly imbricate, irregularly incised or branched. Margins partly flat, partly raised, and additionally occasionally curved downwards, crenate or lobate. Tips broadened, fan-shaped, 5—10 mm broad, flat or raised, crenate, broadly lobate or incised. Upper side of the lobes bluish grey to pale ash-grey and dull in the centre, tanned, very narrowly black-rimmed and sometimes slightly shiny at the tips, frequently not quite smooth, but mealy-rough, usually becoming wrinkled towards the centre, with occasional cortical cracks, without soredia, isidiate. Isidia concolorous with the thallus or purplish brown to dark brown, laminal, becoming more crowded towards the centre, varying from minute warts or truncate warts with indented top to cylindrical outgrowths. Lower side of the lobes black and dull in the centre, turning pale brown and somewhat shiny at the tips, smooth or wrinkled, rhizinose. Rhizinae black, long, simple, becoming wart-like near the tips of the lobes. *Microscopical description.* Upper cortex colourless, with a brownish outer zone, very indistinctly paraplectenchymatous, 15—30 μ. Gonidia bright green, spherical, 9—15 μ, arranged in a layer of 30—50 μ, deeply penetrating into the upper cortex. Medulla colourless, white in reflected light, densely plectenchymatous, gradually merging into the upper cortex, 60—150 μ, composed of leptodermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 9—15 μ. *Apothecia* and *pycnidia* not observed.

Chemical constituents and reactions. Upper cortex K + yellowish, C —, KC + yellow, Pd + slowly yellow, drying up with rust-brown spots. Cortex of the brown isidia Pd + red-brown, N + red-brown. Medulla K —, C + red, KC + orange-brown, Pd + yellowish. This species contains lecanoric acid ($C_{16}H_{14}O_7$) and atranorin ($C_{19}H_{18}O_8$) (Zopf, Flechtenstoffe, 1907, p. 135, 418).

Distribution. When looking up the finds recorded in literature, one might get the impression that *Parmelia scortea* occurs throughout Europe. How far these records refer to this species and not to *P. quercina* (see Hillmann, l. c. p. 190, 199) is difficult to verify. *Parmelia scortea*, however, is stated to be much more common than *quercina.*

Remarks. The species is much more uniform in Holland than it is abroad. In the field it may at once be distinguished from *P. saxatilis* by its thicker and more rounded lobes which lack the reticulate dents and pseudocyphellae. The different medullary reaction is a useful auxiliary feature to rely upon at home.

Key to the varieties.

1a. Thallus with cylindrical isidia var. **scortea** (D. C.) Maas G. f. **eu-scortea** Maas G.
1b. Some of the isidia developing into small laciniae
var. **microphyllina** (Erichs.) A. Zahlbr.

var. **scortea** (D.C.) Maas G. nov. comb. — *Imbricaria quercina* var. *scortea* D. C., Fl. Franç., ed. 3, vol. 6, 1815, p. 187.

Isidia purplish brown or dark brown, varying from wart-like to cylindrical outgrowths, simple or more rarely branched.

var. **scortea** f. **eu-scortea** Maas G. nov. f.

Typus: the same as of *Parmelia scortea.*

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 22, fig. 9; Harm., Lich. France, vol. 4, 1909, tab. 15, fig. 1; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, tab. 2, fig. 3; Laven in Decheniana, vol. 101 AB, 1942, tab. 11, fig. 19; Lynge in Bergens Mus. Aarb., 1910, no. 9, tab. 5, fig. 5; Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 5, fig. 8; Smith et Sowerb., Engl. Bot., vol. 10, 1800, tab. 700 et vol. 29, 1809, tab. 2065; Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 3, fig. 3.

Lobi usque ad 5 mm lati, 2 cm longi, apicibus usque ad 10 mm lati, supra epruinosi, isidiis cylindricis plus minusve confertis muniti. Amphithecium eciliatum.

Lobes up to 5 mm broad and 2 cm long, at the tip broadened up to 10 mm. Upper side epruinose, more or less densely isidiate. Isidia cylindrical. Amphithecium eciliate.

Ecology and frequency. Mainly in open places on deciduous trees; perhaps the species is less rare than may be inferred from the few localities known.

Drente: Eext, 3 V 1941, *Maas G. 736* (L).

Overijsel: Diepenheim-Markelo, 21 VII 1941, *Maas G. 1205* (L); Kampen, *Bondam* (NBV); *Top* (NBV).

Gelderland: Ubbergen, II 1880, *Abeleven* (NBV); Warnsveld, 31 XII 1929, *Wassink 3395* (Wask).

Utrecht: Amersfoort, *Bondam* (NBV); De Bilt, 25 III 1928, *Wassink 211* (Wask); 19 I 1930, *Wassink 129* (Wask); Bilthoven, 18 VI 1933, *Nannenga 27* (Nga).

Noord-Holland: Amsterdam, Kalfjeslaan, 23 X 1943, *Barkman 656* (L).

Zuid-Holland: Harmelen-Woerden, 7 IX 1943, *Maas G. 2792* (L).

Limburg: Epen, 15 VI 1941, *Stafleu* (U); 8 VI 1943, *Van Rossem* (L); Hoogcruts, 16 VII 1942, *Maas G. 2046* (L); Kamerig, 7 VII 1942, *Van Rossem 189, 227, 235* (L); 13 VII 1942, *Maas G. 2012* (L); Kamerig, Belletbeek, 23 VI 1942, *Maas G. 1956* (L); VII 1943, *Meeuse* (L); Terpoorten, 12 VII 1942, *Maas G. 2004* (L); Ubachsberg, 4 VI 1941, *Nannenga 1178* (Nga).

var. **microphyllina** (Erichs.) A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 567 et vol. 10, 1940, p. 534; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 200 — *Parmelia tiliacea* var. *microphyllina* Erichs. in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 20.

Isidia paler than in var. *scortea,* frequently somewhat incrassate at the apex, and some of them developing into small laciniae.

Overijsel: Zwolle, III 1911, *Lako* (L).
Utrecht: Amersfoort, *Bondam* (NBV).
Limburg: Kamerig, 7 VII 1942, *Van Rossem 209* (L); 13 VII 1942, *Maas G. 2017* (L); Valkenburg, 6 VI 1934, *Nannenga 347* (Nga).

21. **Parmelia dubia** (Wulf.) Schaer., Lich. Helvet. Spicil., sect. 10, 1840, p. 453; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 229; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 515 — *Lichen dubius* Wulf. in Jacquin, Collect. Bot., vol. 4, 1790, p. 275 — *Parmelia borreri* Turn. ex Sm. in Smith et Sowerb., Engl. Bot., vol. 25, 1807, p. 1780, pro synon.; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 124; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 153 et vol. 8, 1932, p. 555 (ubi lit. et synon.) — *Imbricaria borreri* Körb., Lichenogr. German. Specim., 1846, p. 9 (non vidi); Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 17.

Macroscopical description. Thallus foliaceous, up to 15 cm in diam. (much smaller in Holland), growing in rosettes or wide-spreading, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, up to about 2 cm long, 1—3 mm broad, more or less wavy, contiguous, overlapping or imbricate, irregularly incised or branched. Margins flat or raised, sometimes crispate, entire, somewhat crenate or servediose. Tips broadened up to 5—8 mm, flat or raised, rounded, crenate or incised. Upper side of the lobes white-grey, bluish grey or yellowish grey, sometimes with a steel-blue, purplish or violet hue, usually darker in the centre, at the tips shiny and sometimes tanned, almost smooth to reticulately or irregularly dented or somewhat wrinkled especially towards the centre, without isidia, sorediate, sometimes with pseudocyphellae faintly indicated at the tips of the lobes. Soralia either laminal or marginal or both, in both cases starting as tiny white dots (soralia maculiformia); the laminal ones frequently marking the ridges between the indentures, somewhat increasing in size towards the centre of the thallus and occasionally coalescing; the marginal soralia separate or confluent (soralia limbiformia). Lower side of the lobes pale brown or whitish, dull, more or less shiny at the tips, smooth or somewhat wrinkled, rhizinose. Rhizinae pale, simple or furcate, usually leaving a fairly broad, bare zone at the tips of the lobes.

Microscopical description. Upper cortex colourless, with a broad brownish exterior zone, indistinctly paraplectenchymatous, 18—30 μ. Gonidia bright green, spherical, 8—15 μ, arranged in clusters or in a continuous layer of 30—60 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 75—130 μ, consisting of leptodermatous hyphae. Lower cortex colourless or brownish, paraplectenchymatous, 9—15 (—18) μ. *Apothecia* not seen. *Pycnides* not common, though sometimes numerous, laminal, visible as dark dots, spherical or pyriform, about 150 μ in diam. Perifulcrium colourless, ostiolum black-brown. Pycnoconidia colourless, cylindrical, slightly curved, ± 1 × 4—6 μ (allegedly 2—3 times as long in var. *stictica*, a variety not indigenous in Holland).

Chemical constituents and reactions. Upper cortex K + yellow, C —, KC + yellowish brown, Pd —. Medulla K —, C + red, KC + red, Pd —. According to Zopf (Flechtenstoffe, 1907, p. 135, 418), the species contains atranorin ($C_{19}H_{18}O_8$) and lecanoric acid ($C_{16}H_{14}O_7$).

Distribution. No finds of this species are recorded from Denmark, Scandinavia, Finland, the Baltic republics, and the U. S. S. R.

Remarks. This species frequently occurs in company with *P. sulcata* from which it may be distinguished in the field by its pale lower surface, and by its far less pronounced pseudocyphellae. Moreover, the bluish thallus of *dubia* dotted with white soralia often reminds me of a starred sky, an impression I never get in *sulcata*.

Key to the varieties and forms.

1a. Lobes with pruinose tips var. **dubia** Maas G. f. **subpruinosa** (Serv.) Hillm.
1b. Lobes epruinose 2
  2a. Thallus without secondary laciniae 3
    3a. Soralia laminal and marginal, or laminal only 4
      4a. Soralia in the centre of the thallus confluent, forming a sorediose crust . . . var. **dubia** Maas G. f. **furfuracea** (Grogn.) Hillm.
      4b. Thallus more or less densely sorediose, laminal soralia not forming a sorediose crust 5
        5a. Lobes in the centre of the thallus with raised, crispate margins. Marginal soralia confluent var. **dubia** Maas G. f. **ulophylla** (Ach.) Maas G.
        5b. Margins if raised not crispate. Marginal soralia not or little confluent, or absent var. **dubia** Maas G. f. **eu-dubia** Maas G.
    3b. Soralia almost exclusively marginal, confluent var. **dubia** Maas G. f. **marginata** (Stein) Hillm.
  2b. Soralia coarse-grained, here and there developing into secondary laciniae var. **dubia** Maas G. f. **granulifera** (Serv.) Maas G.

var. **dubia** Maas G. nov. var.

Typus: the same as of *Lichen dubius.*

Lobi supra albo-grisei vel caesii, nonnumquam colore chalybeo, purpureo vel violaceo perfusi. Pycnoconidia ± 1 × 4 — 6 μ.

Upper side of the lobes white-grey or bluish grey, sometimes with a steel-blue, purplish or violet hue. Pycnoconidia ± 1 × 4 — 6 μ.

var. **dubia** f. **eu-dubia** Maas G. nov. f.

Typus: the same as of *Lichen dubius.*

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 22, fig. 10; Cretzoiu in Inst. Cercetar. Experim. Forest., ser. 2, vol. 47, 1941, tab. 6, fig. 3; Smith et Sowerb., Engl. Bot., vol. 25, 1807, tab. 1780; Turn. in Trans. Linn. Soc. London, vol. 9, 1808, tab. 13, fig. 2; Wulf. in Jacquin, Collect. Bot., vol. 4, 1790, tab. 19, fig. 1.

Thallus magnitudine media. Lobi usque ad 2 cm longi, 2—3 mm lati, apicibus 5—8 mm lati, epruinosi, marginibus non crispatis, esorediosis vel sorediis separatis vel plus minusve confluentibus munitis.

Thallus medium-sized. Lobes up to about 2 cm long, 2—3 mm broad, at the tips broadened up to 5 or 8 mm, epruinose. Margins not crispate, either with or without soralia. Marginal soralia single or somewhat confluent.

Ecology and frequency. On deciduous trees along roads or in open woods, usually in sheltered places, fairly common, though not equably distributed throughout the country.

Groningen: Ter Apel, 28 I 1907, *Tresling* (TA).
Friesland: Sexbierum, 25 VIII 1942, *Maas G. 2185* (L).

Overijsel: Deventer, 't Joppe, 1 IX 1850, *Abeleven* (NBV); Diepenheim, 19 VII 1941, *Maas G. 1145* (L); Kampen, *Top* (L); Markelo, 23 VII 1941, *Maas G. 1249b* (L); Ommen, 28 VII 1941, *Maas G. 1367* (L); Spoolde, I 1909, *Lako* (L); Zwolle, XI 1908, 1—III 1909, *Lako* (L); Zwolle, Dieze, III 1909, *Lako* (L).

Gelderland: Bennekom, *Buse & Buse-Koppiers* (NBV); Bennekom-Veenendaal, Nergena, 23 V 1943, *Maas G. 2487*, transition to f. *ulophylla* (L); Doornspijk, 25 IV 1942, *Maas G. 1824a, 1832* (L); Doornspijk-Elburg, IV 1942, *Maas G. & Van Soest* (VS); Elspeet, Elspeeterbosch, 27 X 1941, *Maas G. 1722* (L); Hierden, 3 IV 1942, *Maas G. 1784* (L); Hierden, Hoophuizen, 24 X 1941, *Maas G. 1574* (L); Hierden, Hulshorst, 24 X 1941, *Maas G. 1562, 1592* (L); Nijkerk, Kruishaer, 17 IV 1866, *Bondam* (L); Velp, V 1849, *Van den Bosch* (NBV); Wageningen, *Buse & Buse-Koppiers* (NBV); Warnsveld, 28 XII 1940, *Wassink 3352* (Wask); 19 VII 1941, *Maas G. 1135* (L); Zalt Bommel, 16 II 1941, *De Jong* (U); Zalt Bommel-Gameren, 20 XII 1942, *Maas G. 2240* (L).

Utrecht: Baarn, Groeneveld, 7 II 1943, *Maas G. 2257* (L); De Bilt, 3 III 1928, *Wassink 3355* (Wask); 19 I 1930, *Wassink 124*, transition to f. *granulifera* (Wask); De Bilt, Oostbroek, 8 VII 1933, *Nannenga 80* (Nga); 1 IV 1942, *Stafleu* (U); Bunnik, 16 VII 1933, *Nannenga 100* (Nga); Harmelen-Vleuten, De Haar, 7 IX 1943, *Maas G. 2790*, transition to f. *ulophylla* (L); Jutphaas, De Hoogt, 23 II 1942, *Stafleu* (U); Leersum, 26 X 1940, *Maas G. 72* (L); 19 IV 1941, *Maas G. 691a* (L); Maartensdijk, 15 XII 1919, *Hart de Ruyter* (U); Odijk, 26 I 1941, *Stafleu* (U); 10 VI 1942, *Maas G. 1935*, transition to f. *ulophylla* (L); Utrecht, Amelisweert, 25 VI 1933, *Nannenga 35a* (Nga); Utrecht, Rijnauwen, 28 V 1941, *Nannenga 1164* (Nga); Vechten, 2 II 1936, *Wassink 3362*, transition to f. *granulifera* (Wask); Veldhuizen-De Meern, 4 IV 1942, *Stafleu* (U).

Noord-Holland: Aerdenhout, 28 VI 1942, *Maas G. 1971* (L); Enkhuizen, 24 VIII 1942, *Maas G. 2151*, transition to f. *granulifera* (L); Oostwoud-Medemblik, 26 IX 1943, *Barkman 610* (L); Wognum, 10 V 1945, *Maas G. 3206* (L).

Zuid-Holland: Ammerstol, 19 VIII 1942, *Maas G. 2142* (L); Dordrecht, I 1848, *Van der Sande Lacoste* (NBV); 's Gravenhage, Haagsche bosch, 15 VI 1941, *Maas G. 944* (L); Lisse, Keukenhof, 8 V 1922, *Ten Kate* (L); 9 III 1942, *Van Rossem 102* (L); Rotterdam, XII 1849, *Van der Sande Lacoste* (NBV); Stompwijk, 7 III 1943, *Maas G. 2306* (L); Wassenaar, 14 V 1942, *Van Soest 811* (VS); Wassenaar, Meiendel, 2 XI 1941, *Maas G. 1765* (L); Zoeterwoude, Vrouwenvaart, V 1922, *Ten Kate* (L).

Zeeland: Walcheren, Middelburg, XII 1912, *Lako* (L); Walcheren, Middelburg-Nieuw en St Joosland, 13 III 1942, *Brakman* (L); Walcheren, Nieuw en St Joosland, 29 XI 1940, 13 III 1942, *Brakman* (L); Walcheren, Souburg, XII 1912, *Lako* (L); Zuid Beveland, *Van den Bosch* (L, NBV); Zuid Beveland, Goes, 12 XI 1943, *Maas G. 2927*, transition to f. *ulophylla* (L); Zuid Beveland, 's Gravenpolder, Zwake, 1843, *Van den Bosch* (NBV); XI 1849, *Van den Bosch*, transition to f. *ulophylla* (NBV); Zuid Beveland, 's Heer Arendskerke, 27 XI 1940, *Brakman* (L); Zuid Beveland, Kloetinge, 12 XI 1943, *Maas G. 2933* (L); Zuid Beveland, Ovezande, Noordijk, 1841, *Van den Bosch* (NBV).

Noord-Brabant: Bergen op Zoom-Woensdrecht, 11 XI 1943, *Maas G. 2913*, transition to f. *granulifera* (L); Breda, 1852, unio NBV (L, NBV); Heeswijk, 11 IX 1934, *Nannenga 501* (Nga); 's Hertogenbosch, 9 VI 1903, *Wakker* (L); Oisterwijk, Groot Speyck, 12 IX 1934, *Nannenga 506* (Nga); Oisterwijk, Oirschotsche baan, 24 VII 1943, *Maas G. 2644* (L); Vught, 26 IV 1908, *Wakker* (L); Westerhoven, 24 VII 1942, *Maas G. 2098*, transition to f. *granulifera* (L).

Limburg: Epen, 16 VI 1941, *Stafleu*, transition to f. *marginata* (U).

var. **dubia** f. **subpruinosa** (Serv.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 232; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 515 — *Parmelia borreri* f. *subpruinosa* Serv. in Hedwigia, vol. 71, 1931, p. 271; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 555.

Upper side of the lobes more or less albo-pruinose at the tips.

Noord-Holland: Heemskerk, III 1942, *Prud'homme van Reine* (L).
Zeeland: Zuid Beveland, *Van den Bosch* (NBV).

var. **dubia** f. **furfuracea** (Grogn.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 232; A. Zahlbr., Cat. Lich.

Univ., vol. 10, 1940, p. 515 — *Parmelia borreri* f. *furfuracea* Grogn. in Roumeg., Lich. Gall. exs., no. 373, 1882 (non vidi).

Laminal soralia strongly developed, hemispherical, partly confluent and forming a sorediose crust.

Remarks. Considering the importance attributed to the kind of the soralia occurring in this species, it is to be regretted that in Hillmann's description nothing is said about the presence or absence of the marginal soralia. Maybe there are some, and if so I could not say if the difference between *furfuracea* and *ulophylla* is sufficient to keep them separate.

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 690b* (L).
Noord-Holland: Midwoud, 12 IV 1945, *Maas G. 3195* (L).
Zeeland: Zuid Beveland, *Van den Bosch* (L, NBV).

var. **dubia** f. **marginata** (Stein) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 232; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 515 — *Parmelia borreri* f. *marginata* Stein in Cohn, Kryptog.-Fl. Schles., vol. 2, pars 2, 1879, p. 71; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 155.

Laminal soralia absent or nearly so; marginal ones well-developed and more or less confluent. Margins of the lobes involute.

Utrecht: Grebbe, 21 V 1943, *Maas G. 2451* (L).

var. **dubia** f. **ulophylla** (Ach.) Maas G. nov. comb. — *Parmelia caperata* var. *ulophylla* Ach., Lichenogr. Univ., 1810, p. 458 — *Parmelia borreri* var. *ulophylla* Nyl. in Flora, vol. 55, 1872, p. 547; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 156 (ubi lit. et synon.) — *Parmelia dubia* var. *ulophylla* Harm. in Bull. Soc. Sci. Nancy, ser. 2, vol. 31, (1896) 1897, p. 224; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 233; A. Zahlbr., Cat. Lich., Univ., vol. 10, 1940, p. 516.

Lobes in the centre of the thallus with raised, crispate and sorediose margins. Laminal soralia large and often confluent.

Remarks. I am somewhat in doubt as to the appearance of this form. The above description is in keeping with those by Harmand and Hillmann, yet it remains to be seen whether it really corresponds with the authentic specimen. The point is that Acharius described his *ulophylla* as "thallo ... nudo subrugoso ...". The original specimen was sent to Acharius from Switzerland by Schleicher; now it appears that in the collections of the Rijksherbarium there are a few specimens extant recorded as "ex Helvetia, Schleicher", some of which exactly fit in with the Acharian description. Are these specimens identical with that sent to Acharius? If so, f. *ulophylla* looks rather like f. *marginata*, and I would not be surprised if the latter should appear to be a synonym of the former! But then, what about the form which answers the above description? First thing to do seems to ascertain whether or not there is a difference between this form and f. *furfuracea* (see there). If this difference would prove to be a real one, the form under discussion has to be renamed.

Gelderland: Warnsveld, 31 XII 1929, *Wassink 3376* (Wask).

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 683a, 687, 688, 690a* (L); De Bilt, Oostbroek, 8 VII 1933, *Nannenga 81* (Nga); Grebbe, Grebbeberg, I 1920, *Keyzer & Florschütz* (U); Harmelen, 7 IX 1943, *Maas G. 2791*, transition to f. *furfuracea* (L); Utrecht, 27 V 1934, *Nannenga 346* (Nga).

Zuid-Holland: Wassenaar, 21 I 1924, *Ten Kate* (L); Wassenaar-Katwijk, 15 III 1921, *Ten Kate* (L).

Zeeland: Zuid Beveland, *Van den Bosch* (NBV); Zuid Beveland, Goes, *Van den Bosch*, transition to f. *granulifera* (NBV).

var. **dubia** f. **granulifera** (Serv.) Maas G. nov. comb. — *Parmelia borreri* f. *granulifera* Serv. in Hedwigia, vol. 71, 1931, p. 271; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 555.

Soredia somewhat coarse-grained, sometimes isidia-like (isidia soredialia), partly developing into secondary folioles. Folioles laminal as well as marginal, entire or incised.

Overijsel: Hellendoorn, 26 VII 1941, *Maas G. 1283b* (L); Zwollerkerspel, 10 V 1941, *Stafleu* (U).

Gelderland: Doornspijk, 13 IV 1942, *Van Soest 633* (VS); 25 IV 1942, *Maas G. 1824b* (L); IV 1942, *Maas G. & Van Soest* (VS); Elspeet, Elspeeter bosch, 27 X 1941, *Maas G. 1722b* (L).

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 683b, 692* (L); Breukelen-Maarssen, 6 VIII 1943, *Maas G. 2710* (L); Jutphaas, 23 II 1942, *Stafleu* (U); Leersum, Darthuizen, 26 VII 1844, *Van Hall* (L).

Zuid-Holland: Leiden, *Molkenboer* (NBV); Noordwijk Binnen, 6 VII 1941, *Maas G. 1044* (L).

Zeeland: Zuid Beveland, *Van den Bosch* (L).

Noord-Brabant: Oisterwijk, Logtsche heide, 23 VII 1943, *Maas G. 2609* (L).

22. Parmelia revoluta Flk., Deutsch. Lich., vol. 1, 1815, p. 11 (non vidi); A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 193 et vol. 10, 1940, p. 532 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 204 — *Imbricaria revoluta* Flot. in Jahresber. Schles. Ges. vaterl. Kult., vol. 28, 1850, p. 129; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 17.

Parmelia laevigata, perlata, tiliacea as cited by Van den Bosch (in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 123—125), and *Imbricaria perlata, sinuosa, tiliacea* as cited by Abelev. (in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 16—17) partly belong to *Parmelia revoluta*.

Macroscopical description. Thallus foliaceous, up to 20 cm in diam. (smaller in Holland), growing in rosettes when young, wide-spreading with age, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, up to about 2 cm long, 1—3 mm broad, rarely flat, usually more or less undulate, contiguous or overlapping, irregularly or pinnately incised or branched, with conspicuously rounded and somewhat widened axils. Margins flat or raised, but additionally here and there curved downwards (revolute), entire. Tips broadened up to about 10 mm, more or less fan-shaped, flat, raised or revolute, lobate or incised. Upper side of the lobes pale grey, ash-grey or grey-green, usually darker in the centre, dull, slightly tanned and shiny towards the tips, sometimes narrowly black-rimmed, smooth or uneven to somewhat wrinkled, without pseudocyphellae or isidia, sorediate. Soralia terminal, subterminal or spreading over the greater part of the thallus, dirty white or grey-greenish. Lower side of the lobes black in the centre of the thallus, brown at the tips, dull or shiny, smooth or somewhat wrinkled, somewhat densely rhizinose, with or without a narrow bare terminal zone. Rhizinae black, simple or furcate, long, turning wart-like towards the tips of the lobes. *Microscopical description.* Upper cortex colourless, with a brownish exterior zone, paraplectenchymatous, 12—20 μ. Gonidia bright green, spherical, 8—12 μ, arranged in a layer of about 30 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 45—120 μ, consisting of leptodermatous hyphae. Lower cortex black-brown, paraplectenchymatous, (9—) 12—18 μ. *Apothecia* not observed. *Pycnids* not common, laminal, immersed in minute warts, spherical or pyriform, 100—150 μ in diam. Perifulcrium dark, ostiolum black-brown. Pycnoconidia colourless, cylindrical, straight, somewhat constricted in the middle, ± 0.8 × 3—5 μ.

Chemical constituents and reactions. Upper cortex K + yellow, slowly turning brownish, C —, KC + red-orange, Pd — or + yellowish. Medulla K —, C + pink or red, KC + orange-red, Pd + yellowish. This species contains atranorin ($C_{19}H_{18}O_8$) and gyrophoric acid ($C_{16}H_{14}O_7$) (Zopf, Flechtenstoffe, 1907, p. 138, 417). Asahina and his collaborators (in Ber. Deutsch. Chem. Ges., vol. 66B, 1933, p. 943 and in Act. Phytochim., vol. 8, 1934, p. 35) write the formula of gyrophoric acid $C_{24}H_{20}O_{10}$. Gyrophoric acid is the principle which stains red with C.

Distribution. *P. revoluta* is considered to have its main area in Southwest Europe (see Degelius in Act. Phytogeogr. Suec., vol. 7, 1935, p. 130), though it may extend far eastward into the continent. It occurs, for instance in Czechoslovakia and Poland, but on the other hand, it is lacking in (or at least no finds are known to me from) Albania, Bulgaria, Greece, Hungary and Rumania. The species is also lacking in the U.S.S.R., Finland, the Baltic republics and Norway, whereas it is very rare in Sweden (see Degelius l. c. p. 127, fig. 26 and in Bot. Notis., 1937, p. 499; ibidem, 1939, p. 394). It is difficult to assume that the species would not occur in Belgium, but it is actually missing in the enumeration by Duvigneaud and Giltay (in Bull. Soc. Roy. Bot. Belg., vol. 70, 1938, Suppl.). This is the more unlikely, since I found *P. revoluta* in Luxemburg.

Remarks. The one species which *P. revoluta* might be confused with is *P. sulcata*. The smooth upper surface, the lack of pseudocyphellae, the entirely different soralia, and the revolute tips of the lobes, however, are, together with the different chemical reactions, reliable characters typical for *revoluta*.

It is worth noticing that among the oceanic lichens mentioned by Degelius (in Act. Phytogeogr. Suec., vol. 7, 1935, p. 130) *Parmelia revoluta* is the sole species which more or less successfully withstands the unfavourable climatic conditions of Holland.

Key to the forms.

1a. Soralia more or less confined to the tips of the lobes
f. **revoluta** (Flot.) Maas G.
1b. Soralia spreading over the greater part of the thallus 2
  2a. Soralia forming an areolate sorediose crust f. **rugosa** (Tayl.) Cromb.
  2b. Some of the soredia isidioid and developing into secondary laciniae
f. **foliolifera** Erichs.

f. **revoluta** (Flot.) Maas G. nov. comb. — *Parmelia sinuosa* var. *revoluta* Flot. in Rabenh., Deutschl. Kryptog.-Fl., vol. 2, pars 1, 1845, p. 59.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 23, fig. 4; Degel. in Bot. Notis., 1932, p. 279, fig. 1; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 21, fig. 6 (indistinct).

Lobes up to about 2 cm long, 1—3 mm broad, at the tips broadened up to 10 mm. Soralia terminal or subterminal, somewhat dispersed, gradually increasing in size and consuming more and more of the upper cortex. Soredia fine-grained.

Ecology and frequency. Not rare, presumably only restricted in its distribution by the lack of suitable habitats which to an increasing extent are being destroyed. It is a hygrophilous species, growing at the base of old deciduous trees (oaks and beeches), or over mosses enveloping tree-trunks in open woods.

Remarks. I consider this form identical with the type of *Parmelia revoluta*.

Groningen: Haren, Glimmen, 3 XII 1866, *Holkema* (NBV); Haren, Harendermolen, 3 XII 1866, *Van Hall* (NBV).

Drente: Eelde, Oosterbroek, 16 VIII 1858, *Van Hall* (NBV); Hoogeveen, 12 XII 1940, *Maas G. 258* (L).

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1148* (L); Heino, II 1909, *Lako* (L); Kampen, *Top* (NBV).

Gelderland: Apeldoorn, 't Loo, VIII 1849, unio NBV (NBV); Bennekom, 1850, *Buse & Buse-Koppiers* (NBV); Hierden, Hulshorst, 24 X 1941, *Maas G. 1563*, transition to f. *foliolifera* (L); Leuvenum, Leuvenumsche bosch, 26 X 1941, *Maas G. 1671* (L); Nijmegen, Meerwijk, 13 VIII 1873, *Van Hall* (L); Renkum, *Buse & Buse-Koppiers* (NBV); Wageningen, *Buse & Buse-Koppiers* (NBV).

Utrecht: Amersfoort, 27 XI 1942, *Van Rossem 689* (L); Baarn, Groeneveld, 7 II 1943, *Maas G. 2260, 2267, 2273* (L); De Bilt, 8 III 1930, *Wassink 231* (Wask); De Vuursche, Lage Vuursche, 15 II 1941, *Nannenga 1109, 1116* (Nga); Huis ter Heide, 17 VII 1859, *Van Hall* (NBV).

Zuid-Holland: Lisse, Keukenhof, 11 VI 1942, *Van Rossem 156, 158* (L); Wassenaar, Meiendel, 12 X 1941, *Maas G. 1534* (L); 2 XI 1941, *Maas G. 1768* (L).

Zeeland: Zuid Beveland, *Van den Bosch* (NBV); Zuid Beveland, 's Gravenpolder, Zwake, X 1849, *Van den Bosch* (NBV).

Noord-Brabant: Bergen op Zoom-Woensdrecht, 11 XI 1943, *Barkman 693* (L); Breda, *Van den Bosch* (L); 1852, unio NBV (NBV).

f. **foliolifera** Erichs. in Ann. Mycol., vol. 39, 1941, p. 25.

Thallus small. Soralia more or less covering the upper surface, rather than being limited to the tips of the lobes. Soredia coarse-grained, isidioid, and partly growing out into secondary laciniae which may develop soralia in their turn.

Drente: Anlo, 3 V 1941, *Maas G. 771* (L); Eext, 5 V 1941, *Maas G. 896* (L).

Gelderland: Bennekom, Hullenberg, 6 IX 1942, *Maas G. 2213* (L).

f. **rugosa** (Tayl.) Cromb. in Grevillea, vol. 15, 1887, p. 75; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 207; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 532 — *Parmelia rugosa* Tayl. in Mack., Fl. Hibern., vol. 2, 1836, p. 145 (non vidi) — *Parmelia revoluta* var. *rugosa*; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 196 (ubi lit. et synon.).

Soralia more or less spreading over the whole thallus, forming a sorediose crust.

Gelderland: Renkum, *Buse & Buse-Koppiers* (L).

23. Parmelia sulcata Tayl. in Mack., Fl. Hibern., vol. 2, 1836, p. 145 (non vidi); A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 216; vol. 8, 1932, p. 568 et vol. 10, 1940, p. 537 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 215.

Imbricaria (or *Parmelia*) *tiliacea* var. *furfuracea* and most of *Imbricaria* (or *Parmelia*) *saxatilis* as quoted by Abeleven (in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 124) and by Van den Bosch (ibidem, vol. 2, pars 2, 1853, p. 17) belong to *Parmelia sulcata.*

Macroscopical description. Thallus foliaceous, medium-sized to large, up to 20 cm in diam. (though much smaller in Holland), growing in rosettes when young, later on more wide-spreading, varying from closely appressed to loosely adhering, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, variable in size and form, usually 1—2 cm long, but sometimes less, and in other cases again attaining as much as 5—6 cm, 1—3 mm broad, more or less strongly undulate, sometimes twisted, varying from discrete, contiguous, overlapping, imbricate to entangled, irregularly incised or branched. Margins flat or raised, entire, slightly crenate or sorediate. Tips broadened, up to 5—7 mm broad, flat, raised or sometimes revolute, somewhat jagged, emarginate or incised. Upper side of the lobes ash-grey, bluish grey or with a brownish hue, in some cases almost white, darker in the centre of the thallus, usually with tanned tips, entirely dull or shiny, with or without pruina, smooth or more or less strongly reticulately dented, either with or almost without pseudocyphellae and soralia. Pseudocyphellae white, occurring at the tips of the lobes, of irregular form, bordering the indentures, towards the centre of the thallus passing into soralia. Soralia greyish or whitish, occasionally bluish-pruinose, either laminal and arising from the pseudocyphellae which have frequently widened into deep fissures or marginal; they are roundish or long-drawn (soralia rimiformia), the marginal ones frequently confluent. Lower side of the lobes black in the centre of the thallus, brown at the tips, more or less shiny, smooth or somewhat wrinkled, densely rhizinose up to the very tips or rhizinae passing into warts or tips of the lobes with a narrow bare zone. Rhizinae black, long, simple or furcate, sometimes protruding sideways from the lobes. *Microscopical description.* Upper cortex colourless, with a brownish outer zone, paraplectenchymatous, 15—20 (—28) μ. Gonidia bright green, spherical, 6—15 μ, arranged in a layer of 35—60 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 60—200 μ, composed of meso- or leptodermatous hyphae. Lower cortex black-brown, paraplectenchymatous, 12—18 μ. *Apothecia* very rare, laminal, sessile or with constricted base, at first cup-shaped, later on saucer-shaped, up to 4 or 5 mm in diam. Amphithecium concolorous with the upper side of the thallus or with a black patch at the base, dull, smooth. Margin persistent, very soon completely sorediose. Disc chestnut, dull or somewhat shiny, smooth. Epithecium brownish, hymenium colourless, hypothecium colourless or yellowish, with a gonidial layer underneath. Hymenium 50—75 μ. Asci clavate, 15—18 × 24—48 μ, or abortive, sterile or with imperfectly developed spores. Paraphyses conglutinate, septate, simple or furcate. *Pycnidia* not observed.

Chemical constituents and reactions. Upper cortex K + yellow, C —, KC + yellow, Pd —. Medulla K + yellow, slowly turning red-brown, C —, KC + red-brown, Pd + yellow, changing into orange. Atranorin ($C_{19}H_{18}O_8$) and protocetraric acid ($C_{54}H_{42}O_{27}$) have been reported to occur in this species (Zopf, Flechtenstoffe, 1907, p. 417). According to Asahina and Tanase (in Ber. Deutsch. Chem. Ges., vol. 67B, 1934, p. 411—416), the formula of protocetraric acid is $C_{18}H_{14}O_9$.

Distribution. *P. sulcata* is a common species throughout Europe.

Remarks. As in most other common species, quite a number of varieties and forms of *P. sulcata* are known in literature. Without having seen the authentic specimens, however, or without reliable exsiccata for comparison it is impossible to decide whether the indigenous material now included in var. *sulcata* f. *eu-sulcata* should be assigned to any of them. But, as a rule, the material is fairly homogeneous. On the whole, the variability of *Parmelia sulcata* is very poor in this country, being roughly limited to the presence or absence of secondary laciniae, and to the kind of the reticulation. Secondary lobes are shown in f. *prolifera,* whereas a faint or almost lacking reticulation on the upper side of the lobes is common to f. *munda* (soralia almost lacking) and to f. *pruinosa* (lobes pruinose). These forms, deviating only slightly from the type of *sulcata,* are subordinate to var. *sulcata,* along with f. *eu-sulcata* which is characterised by the strongly marked reticulations and the lack of secondary lobes. Another form with faint reticulation is f. *eu-discreta* which on account of some additional differences belong to var. *discreta.*

Just like *Parmelia saxatilis,* this species is liable to become stained with brick-red patches. Such forms have been described as f. *rubescens* by Harmand (Lich. France, vol. 4, 1909, p. 567), though the significance is rightly disputed by Hillmann (l. c. p. 219).

Again as in *saxatilis,* specimens of *sulcata* growing on the exposed boulders of the cairns in Drente (cf. p. 22) show much smaller and more imbricate lobes than the arboricolous ones. I do not know whether these forms are concerned with f. *microphylla* as described by Bouly de Lesdain (Rech. Lich. Dunkerque, suppl. 1, 1914, p. 70).

Incidentally (e. g. no. 1117, Mantingerbosch, Drente, 9 V 1941) plants may be found quite differing from what is looked upon as the typical *sulcata,* being composed of very long (4—5 cm) and slender lobes which for the greater part are detached from the substratum much in the way of some *Ramalina.* Such specimens are not unlike var. *contortoides* A. Zahlbr. (in Verh. Zool.-Bot. Ges. Wien, vol. 76, 1927, p. 97), but differ from it in that their lobes are not twisted, and have no canaliculate lower side either.

Key to the varieties and forms.

1a. Secondary laciniae developing from the soralia
var. **sulcata** (Linds.) Maas G. f. **prolifera** Erichs.
1b. Thallus without secondary laciniae 2
  2a. Lobes partly covered with a white pruina
  var. **sulcata** (Linds.) Maas G. f. **pruinosa** (Harm.) Maas G.
  2b. Lobes epruinose 3
    3a. Lobes esorediate or nearly so, reticulations faint 4
      4a. Lobes long, narrow, discrete, stellate, tightly appressed
      var. **discreta** (Oliv.) Hillm. f. **eu-discreta** Maas G.
      4b. Thallus not as above, lobes neither discrete nor stellate
      var. **sulcata** (Linds.) Maas G. f. **munda** Oliv.
    3b. Lobes strongly sorediate, reticulations well marked
    var. **sulcata** (Linds.) Maas G. f. **eu-sulcata** Maas G.

var. **sulcata** (Linds.) Maas G. nov. comb. — *Parmelia saxatilis* var. *sulcata* Linds. in Trans. Roy. Soc. Edinburgh, vol. 22, 1859, p. 228.

Lobes neither tightly appressed and discrete, nor loosely adhering and twisted.

Remarks. Some words may be said about the choice of the varietal epithet. Zahlbruckner (Cat. Lich. Univ., vol. 6, 1929, p. 216) mentions for the oldest subdivisional name *Parmelia saxatilis* var. *rosaeformis* Ach. (Lichenogr. Univ., 1810, p. 470), on which Th. M. Fries (Lichenogr. Scand., vol. 1, 1871, p. 115) already remarked: "Var. *rosaeformis* Ach. ... sec. ipsius herb. composita est e *P. saxatili β sulcata* et forma isidiosa *Cetrariae glaucae*". Though Gyelnik (in Fol. Cryptog., vol. 1, pars 6, 1928, p. 592) tried to prove that the epithet *rosaeformis* could not refer but to our *P. sulcata*, the fact of Acharius' error remains, and with it the chance of confusion in case this epithet should be re-established. It will, therefore, not be used here.

The next oldest name is *Imbricaria saxatilis* var. *leucochroa* Flot. (in Jahresber. Schles. Ges. vaterl. Kult., vol. 28, 1850, p. 129). It appears, however, that Von Flotow refers to Wallroth's *Parmelia saxatilis* var. *leucochroa* (= *Parmelia saxatilis*), and some of the cited exsiccata, too, indicate that Von Flotow meant *P. saxatilis*. So, the epithet *leucochroa* does not apply here either.

Finally, as regards *Imbricaria saxatilis* var. *corticicola*, this is a name established by Rabenhorst and labeled to his exsiccata Flecht. Europ., fasc. 12, 1858, no. 349, but since no description was added it is a nomen nudum.

var. **sulcata** f. **eu-sulcata** Maas G. nov. f.

Typus: the same as of *Parmelia sulcata*.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 23, fig. 3; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, tab. 2, fig. 4; Lynge in Bergens Mus. Aarb., 1910, no. 9, tab. 5, fig. 3; Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 5, fig. 5; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 22, fig. 6 (indistinct); Schulz-Korth in Rep. spec. nov. regn. veg. Beih., vol. 67, 1931, tab. 18, fig. 34; Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 6, fig. 2, 3 (indistinct).

Lobi 1—2 cm longi, 1—3 mm lati, apicibus 5—7 mm lati, plus minusve undulati, contigui vel marginibus tegentes, supra cinerei vel caesii, opaci vel apicibus quodam modo nitentes, epruinosi, plus minusve reticulato-lacunosi, pseudocyphellis et sorediis epruinosis instructi.

Lobes 1—2 cm long, 1—3 mm broad, at the tips broadened up to 5 or 7 mm, more or less wavy, contiguous or overlapping. Upper side ash-grey to bluish grey, dull or with somewhat shiny tips, epruinose, more or less strongly reticulately dented, pseudocyphellate and sorediate. Soralia epruinose.

Ecology and frequency. The commonest form of the most common species, occurring on deciduous trees and fences, as well as on concrete and boulders, rarely on the ground.

This species is often, together with *P. subaurifera* or *P. exasperatula*, among the first foliaceous lichen epiphytes on the smooth bark of young road-side trees.

For the differences from *P. dubia* and *P. revoluta*, see there.

Groningen: Beerta, Nieuw Beerta, 22 VIII 1933, *Nannenga 267, 279a* (Nga); Groningen, 10 III 1866, *Holkema* (NBV); Groningen, Sterrebosch, 5 V 1852, *Van Hall* (NBV); III 1855, *Acker Stratingh* (Gro); Groningen-Haren, *Acker Stratingh* (Gro); Haren, 18 III 1854, *Van Hall* (NBV); Haren, Harendermolen, *Acker Stratingh* (Gro, NBV); Ter Apel, 28 XII 1906, 29 I 1907, *Tresling* (TA).

Friesland: Mirns, 2 XII 1928, *Koopmans* (Koopm); Sexbierum, 25 VIII 1942, *Maas G. 2184* (L); Wons, 20 IV 1929, *Koopmans* (Koopm).

Drente: Angelsloo, 15 VII 1939, *Van Ooststroom & Zaneveld* (L); 8 V 1941, *Maas G. 1101, 1105* (L); Anlo-Zuidlaren, 3 V 1941, *Maas G. 757b* (L); Bronneger, 6 V 1941, *Maas G. 967, 971, 985* (L); Drouwen, 6 V 1941, *Maas G. 936* (L); Drouwen, Drouwenerveld, 6 V 1941, *Maas G. 962* (L); Emmen, Emmerveld, 8 V 1941, *Maas G. 1080* (L); Frederiksoord, 1 XI 1942, *Van Rossem 517, 519, 520* (L); Hoogeveen, 12 XII 1940, *Maas G. 255*, transitions to f. *munda* and f. *prolifera* (L); Lhee, 31 VIII 1932, *Lütjeharms 116* (L); Loon, 10 V 1941, *Maas G. 1125* (L); Mantinge, Mantinger bosch, 9 V 1941, *Maas G. 1117* (L); Noordsleen, 9 V 1941, *Maas G. 1108, 1114* (L); Peterswolde, IX 1855 (Gro); Rhee, 4 V 1941, *Maas G. 791*, transition to f. *munda* (L); Schipborg, 5 V 1941, *Maas G. 923* (L); Smilde, 1849, *Van den Bosch*, transition to f. *munda* (NBV); Ubbena, 4 V 1941, *Maas G. 804* (L); Valthe, 16 VII 1939, *Van Ooststroom & Zaneveld* (L); 7 V 1941, *Maas G. 1063* (L); Valthe, Valtherveld, 7 V 1941, *Maas G. 1052* (L).

Overijsel: Bathmen, Zuid Loo, 1 IX 1850, *Abeleven*, c. ap. (NBV); Beckum, 22 VII 1941, *Maas G. 1233* (L); Dalfsen, III 1909, *Lako* (L); XI 1912, *Lako* (NBV); XII 1912, *Lako* (L); Heino, XI 1912, *Lako* (L, NBV); Hellendoorn, 26 VII 1941, *Maas G. 1283a* (L); Kampen, *Bondam* (L, NBV); III 1889, *Top* (L); Lemele, 28 VII 1941, *Maas G. 1361* (L); Lemele, Lemelerberg, 27 VII 1941, *Maas G. 1314* (L); Raalte, I 1909, *Lako* (L, NBV); Spoolde, XI 1908, *Lako* (L); Vollenhove, 22 VII 1928, *Koopmans* (Koopm); IJselmuiden, Oosterholt, *Bondam*, transition to f. *pruinosa* (L); IV 1889, *Top* (L); Zeesse, 28 VII 1941, *Maas G. 1369* (L); Zwolle, XI 1908, II, III 1909 (NBV); I 1909, XII 1912, VII 1916, *Lako* (L); Zwolle, Katerveer, V 1889, *Top* (NBV).

Gelderland: Bennekom, 6 IX 1942, *Maas G. 2207* (L); Bennekom-Veenendaal, Nergena, 23 V 1943, *Maas G. 2467* (L); Doornspijk, IV 1942, *Maas G. & Van Soest* (VS); Doornspijk, Nieuw Soerel, IV 1942, *Maas G. & Van Soest*, transition to f. *munda* (VS); 25 IV 1942, *Maas G. 1853*, transition to var. *discreta* f. *eu-discreta* (L); Doornspijk, Soerel, 25 IV 1942, *Maas G. 1868* (L); Doorwerth, 1849, *Buse & Buse-Koppiers* (NBV); Ede, 11 IV 1941, *Maas G. 671* (L); Harderwijk, *Bondam* (NBV); Hierden, VIII 1939, *Groot & Van Soest 321* (VS); Hierden, Hoophuizen, 24 X 1941, *Maas G. 1580* (L); Hoef, 21 II 1866, *Bondam* (L); 25 X 1941, *Maas G. 1615*, transition to f. *pruinosa* (L); Nulde, 25 X 1941, *Maas G. 1607* (L); Nijkerk, 6 III 1866, *Bondam* (L); 6 III 1866, 7 IV 1866, *Stolz* (L); 29 III 1936, *Nannenga 1234a* (Nga); Nijmegen, *de Beyer* (NBV); VII 1846, II 1847, *Abeleven* (NBV); Nijmegen, Mariënboom, *Abeleven* (NBV); Putten, Putter bosch, III 1869, *Stolz* (L); Renkum, *Buse* (L); *Buse & Buse-Koppiers* (L); *Buse*, transition to f. *pruinosa* (L); Staverden, 27 X 1941, *Maas G. 1743* (L); Ubbergen, VII 1846, *Abeleven*, transition to f. *pruinosa* (L); Winterswijk, Bekkendelle, 14 IV 1941, *Nannenga 286* (Nga).

Utrecht: Amersfoort, *Bondam* (NBV); 27 XI 1942, *Van Rossem 684, 697* (L); Baarn, VIII 1873, *Oudemans* (Gro); Baarn, Groeneveld, 7 II 1943, *Maas G. 2259* (L); Baarn, Soestdijk, VIII 1873, *Oudemans* (Gro, L, NBV, U); De Bilt, 1 IV 1942, *Stafleu* (U); Bunnik, 25 VI 1933, *Nannenga 30, 32* (Nga); 16 VII 1933, *Nannenga 99* (Nga); III 1941, *Stafleu* (U); Kockengen, 6 VIII 1943, *Maas G. 2687* (L); Leersum, 26 X 1941, *Maas G. 59* (L); Leersum, Darthuizen, 25 VII 1848, *Van Hall* (NBV); Odijk, 26 I 1941, *Stafleu* (U); Utrecht, 1840, *Van der Sande Lacoste*, transition to f. *pruinosa* (L); 1841, *Van der Sande Lacoste* (NBV); 30 XI 1879, *Moll* (Gro); De Vuursche, Lage Vuursche, 15 II 1941, *Nannenga 1120, 1121b* (Nga).

Noord-Holland: Aerdenhout, 28 VI 1942, *Maas G. 1968* (L); Amsterdam, Kalfjeslaan, VI 1847, *Van der Sande Lacoste* (NBV); Amsterdam, Rustenburgerpad, XII 1848, *Van der Sande Lacoste* (NBV); Bloemendaal, 1838, *Buse & Gildemeester-Buse*, c. ap. (NBV); Castricum, Bakkum, III 1940, *Stafleu* (U); Haarlem, *Buse & Gildemeester-Buse* (NBV); *Van Hall* (NBV); *De Vriese* (NBV); V 1870, *Oudemans* (Gro); Heiloo, 15 V 1942, *Stafleu* (U); Oostwoud-Hauwert, 8 IV 1945, *Maas G. 3163* (L); Santpoort, 1839, *Buse & Gildemeester-Buse* (NBV); Texel, Binnen Muy, 13 V 1942, *Stafleu* (U); Texel, De Muy, 10 V 1942, *Stafleu* (U); Texel, Westerduinen, IV 1940, *Stafleu*, transition to f. *pruinosa* (U); Texel, Westermient, 10 V 1942, *Stafleu* (U); Velzen, Velzeroord, 12 V 1946, *Groenhart* (L); Vogelenzang, *Buse* (NBV); Wognum, 10 V 1945, *Maas G. 3207* (L).

Zuid-Holland: Ammerstol, 19 VIII 1942, *Maas G. 2139*, transition to f. *munda* (L); De Zilk, 12 V 1947, *Maas G. 3681*, c. ap. (L); 's Gravenhage, Scheveningsche Boschjes, 10 V 1942, *Van Soest 813* (VS); Katwijk, *De Haan* (L); Katwijk-Wassenaar, 11 VII 1944, *Barkman 785*, c. ap. (L); Leiden, *Dozy* (NBV); *Molkenboer* (L, NBV); Leiden, Haagsche Schouw, *Schuurmans Stekhoven* (NBV); Lisse, Keukenhof, 25 III 1942, *Van Rossem 67* (L); 30 VII 1942, *Van Rossem 299* (L); Loosduinen, Ockenburg, 20 VII 1851, *Abeleven*, c. ap. (NBV); Monster, 1851, unio NBV (NBV); Naaldwijk, *Van der Trappen*, c. ap. (NBV); IX 1872, *Van der Trappen* (Gro); Oegstgeest, 18 VI 1942, *Van Rossem 166* (L); Oegstgeest, Oud Poelgeest, 2 V 1941, *Barkman* (L); Rijnsburg-Valkenburg, 4 III 1942, *Van Rossem 106*, transition to f. *munda* and f. *prolifera* (L); Scheveningen, 8 V 1936, Miss *Koster 626* (L); 19 IV 1942, *Maas G. 1814* (L); Stompwijk, 7 III 1943, *Maas G. 2305*, transition to f. *prolifera* (L); Ter Aa-Vinkeveen, 12 VIII 1943, *Maas G. 2732* (L); Vianen, *Van Hall* (NBV); Warmond, 12 IV 1921, *Ten Kate* (L); Wassenaar, 1839, *Buse* (NBV); IV 1919, *Ten Kate* (U); Wassenaar, Meiendel, 21 X 1922, *Ten Kate* (L); 1939, *Groot & Van Soest 507*, c. ap. (VS); 21 VI 1939, *Groot & Van Soest 114*, c. ap., partly transition to f. *prolifera* (VS); 5 VII 1941, *Stafleu* (U); 6 IX 1941, *Maas G. 1422, 1423* (L); 2 XI 1941, *Maas G. 1766, 1770* (L); 15 III 1942, *Van Rossem 80a, 81, 85* (L); 10 V 1942, *Van Rossem 135, 141* (L); 27 IX 1942, *Van Rossem 328* (L).

Zeeland: Walcheren, *Lako* (NBV); 1879, *Lako* (L); Walcheren, Middelburg, I 1909, XII 1912, *Lako* (L); Walcheren, Middelburg-Nieuw en St Joosland, 13 III 1942, *Brakman* (L); Walcheren, Oostkapelle, 1877, *Frederiks*, c. ap. (L); Walcheren, Souburg, I 1909, *Lako* (L); Zuid Beveland, *Van den Bosch* (NBV); V 1842, *Van den Bosch* (L); Zuid Beveland, Kloetinge, 12 XI 1943, *Maas G. 2935* (L).

Noord-Brabant: Beek, IX 1849, *Van den Bosch*, c. ap. (NBV); Boxtel, IV 1924, *Smelt* (VD Wijk); Esch-Vught, 22 I 1902, *Wakker* (L); 's Hertogenbosch, IV 1898, *Wakker* (L).

Limburg: Epen, 22 VI 1942, *Maas G. 1950* (L); Holset, 13 VII 1942, *Maas G. 2027* (L); Maastricht, *Franquinet* (L); Mook, Plasmolen, 8 IV 1942, *Stafleu* (U); Schüller-Gulpen, 9 VII 1942, *Van Rossem 219* (L); Terziet, Bovenste bosch, 16 VII 1942, *Maas G. 2038*, transition to f. *pruinosa* (L).

var. **sulcata** f. **pruinosa** (Harm.) Maas G. nov. comb. — *Parmelia sulcata* var. *pruinosa* Harm., Lich. France, vol. 4, 1909, p. 567; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 218 et vol. 10, 1940, p. 537; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 220.

Lobes here and there covered with a white pruina; reticulate dents hardly visible.

Overijsel: Hellendoorn, 26 VII 1941, *Maas G. 1283c* (L).

Gelderland: Renkum, 1848, *Buse & Buse-Koppiers* (NBV).

Utrecht: Utrecht, Amelisweert, 25 VI 1933, *Nannenga 35b* (Nga); Utrecht, Rijnauwen, 28 V 1941, *Nannenga 1164b* (Nga).

Noord-Holland: Haarlem, Woestduin, 1838, *Buse & Gildemeester-Buse* (L); Velzen, 1841, *Buse & Gildemeester-Buse* (NBV).

Zuid-Holland: Noordwijk Binnen, 6 VII 1941, *Maas G. 1044a*, transition to f. *prolifera* (L); Stompwijk, 7 III 1943, *Maas G. 2304* (L); Warmond, 10 III 1942, *Van Rossem 103b* (L).

var. **sulcata** f. **munda** Oliv. in Rev. de Bot., vol. 12, 1894, p. 66; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 218; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 537 — *Parmelia saxatilis* var. *sulcata* f. *munda* Oliv., Fl. Lich. Orne, 1882, p. 69 — *Parmelia sulcata* var. *pruinosa* f. *munda* Harm.; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 219 (ubi lit.).

Thallus esorediate. Lobes with faint reticulations.

Groningen: Beerta, Nieuw Beerta, 3 VI 1933, *Nannenga 18* (Nga); 22 VIII 1933, *Nannenga 279b* (Nga); Ter Apel, 24 XII 1906, *Tresling* (TA).

Drente: Anlo-Zuidlaren, 3 V 1941, *Maas G. 757a* (L).

Overijsel: Almelo, Aadijk, 27 XII 1940, *Van Ooststroom 7442* (L); Dalfsen, III 1909, *Lako* (L); Lemele, Lemelerberg, 27 VII 1941, *Maas G. 1313* (L).

Gelderland: Nijkerk, 29 III 1936, *Nannenga 1234b* (Nga); Uddel, Uddelermeer, 1849, unio NBV (NBV).

Utrecht: Utrecht, Rijnauwen, 28 V 1941, *Nannenga 1164a* (Nga); Tienhoven, 6 VII 1942, *Maas G. 1991* (L); De Vuursche, Lage Vuursche, 15 II 1941, *Nannenga 1107a* (Nga).

Noord-Holland: Bergen, 16 XI 1940, *Maas G. 209* (L); Overveen, 1839, *Buse & Gildemeester-Buse* (NBV).

Zuid-Holland: Den Deyl, Zuidwijk, 5 IV 1941, *Barkman* (L); Lisse, Keukenhof, 9 III 1942, *Van Rossem 96b* (L); Naaldwijk, IX 1872, *Van der Trappen* (Gro); Noordwijk Binnen, 6 VII 1941, *Maas G. 1042* (L); Oegstgeest, 20 X 1940, *Maas G. 38* (L); Scheveningen, 19 IV 1942, *Maas G. 1813* (L); Wassenaar, Meiendel, 31 X 1940, *Maas G. 104* (L).

Zeeland: Walcheren, Nieuw en St Joosland, 17 III 1942, *Brakman* (L).

var. **sulcata** f. **prolifera** Erichs. in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 19; A. Zahlbr., Cat. Lich. Univ., vol. 8, 1932, p. 568 et vol. 10, 1940, p. 537; Hillm. in Rabenh., Kryptog-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 218.

Thallus particularly in the centre strongly sorediose, with secondary folioles growing out of the soralia, more rarely developing from the margins.

Remarks. The producing of secondary laciniae which is also frequently met with in many other species is particularly common in *sulcata*; specimens of f. *prolifera* may be found abundantly in Holland. No doubt there is some relation with the climatic conditions, and I am inclined to take the prevailing wind for the main cause, as in most cases this form has been collected from exposed places. I do not know whether it is the mechanical or the desiccating action of the wind upon which the thallus reacts.

Not infrequently f. *prolifera* is linked up with f. *pruinosa* by intermediate stages showing a white pruina covering the lobes as well as the secondary laciniae. Furthermore, peculiar intermediates may be found which have few soralia or none at all, and faint reticulations, thus resembling f. *munda*.

Groningen: Beerta, Ekamp, 28 VIII 1941, *Nannenga 1200* (Nga); Beerta, Nieuw Beerta, 22 VIII 1933, *Nannenga 298* (Nga); Groningen-Haren, *Acker Stratingh* (Gro, NBV); Haren, Harendermolen, *Acker Stratingh* (Gro).

Drente: Anlo-Zuidlaren, 3 V 1941, *Maas G. 757c* (L); Noordlaren, 5 V 1941, *Maas G. 919* (L); Norg-Een, 4 V 1941, *Maas G. 880* (L); Westerveld, 4 V 1941, *Maas G. 875* (L).

Overijsel: Kampen, *Top* (L, NBV); Markelo, 21 VII 1941, *Maas G. 1206* (L); 23 VII 1941, *Maas G. 1249, 1249a* (L); Markelo-Laren, 23 VII 1941, *Maas G. 1264a* (L); Zwolle, I 1909, *Lako* (L).

Gelderland: Doornspijk, 25 IV 1942, *Maas G. 1823* (L); Hoenderloo, 26 III 1943, *Maas G. 2332* (L); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2367* (L); Nulde, 25 X 1941, *Maas G.* (L); Renkum, Duno-Heveadorp, 9 II 1941, *Stafleu* (U); Staverden, 27 X 1941, *Maas G. 1742* (L).

Utrecht: De Bilt, Oostbroek, 1 IV 1942, *Stafleu* (U); Doorn, 20 IV 1941, *Maas G. 701* (L); Kockengen, 6 VIII 1943, *Maas G. 2687* (L); Leersum, 19 IV 1941, *Maas G. 691b* (L); Leersum, Darthuizen, VI 1836, *Van Hall* (NBV); Odijk, 26 I 1941, *Stafleu* (U); Utrecht, Rijnauwen, 21 III 1941, *Nannenga 1140* (Nga); Vechten, 16 II 1941, *Stafleu* (U); Veldhuizen-De Meern, 4 IV 1942, *Stafleu*, transition to f. *pruinosa* (U).

Noord-Holland: Enkhuizen, 24 VIII 1942, *Maas G. 2160*, transition to f. *pruinosa* (L); Haarlem, Haarlemmerhout, *Van Hall* (L); Zandvoort, 1840, *Buse & Gildemeester-Buse* (NBV).

Zuid-Holland: Ammerstol, 19 VIII 1942, *Maas G. 2143*, transition to f. *pruinosa* (L); Hillegom, 16 III 1942, *Van Rossem 89* (L); Lisse, Keukenhof, 25 III 1942, *Van Rossem 61, 64a* (L); Loosduinen, Ockenburg, 20 VII 1851, *Abeleven*, c. ap. (NBV); Noordwijk Binnen, 6 VII 1941, *Maas G. 1044a*, transition to f. *pruinosa* (L); Scheveningen, 19 IV 1942, *Maas G. 1815* (L); Wassenaar, 21 IX 1941, *Wachter* (L); Wassenaar, Meiendel, 5 VII 1941, *Stafleu*, transition to f. *pruinosa* (U); 13 VII 1941, *Maas G. 1085* (L).

Zeeland: Walcheren, Arnemuiden, Sloedam, 1 V 1941, *Brakman* (L); Walcheren, Nieuw en St Joosland, 13 III 1942, *Brakman*, transition to f. *pruinosa* (L); Walcheren, St. Laurens, XII 1912, *Lako* (L); Zuid Beveland, Goes, IV 1848, *Van den Bosch* (NBV); 12 XI 1943, *Maas G. 2924* (L); Zuid Beveland, 's Heer Arendskerke, 3 V 1941, *Brakman* (L); Zuid Beveland, Nieuwdorp, 30 XI 1940, *Brakman* (L).

Noord-Brabant: Bergeyk, 22 VII 1942, *Maas G. 2064* (L); Vught, 18 VI 1903, *Wakker* (L).

var. **discreta** (Oliv.) Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 220; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 537 — *Parmelia saxatilis* var. *sulcata* f. *discreta* Oliv. in Rev. de Bot., vol. 10, 1892, p. 618.

Thallus tightly appressed. Lobes long, narrow, discrete, stellate, with faint reticulations and few soralia or esorediate, with or without a whitish or bluish pruina. Rhizinae long, occasionally almost marginal, and protruding sideways.

var. **discreta** f. **eu-discreta** Maas G. nov. f.

Typus: the same as of *P. saxatilis* var. *sulcata* f. *discreta.*

Lobi epruinosi.

Lobes epruinose.

Ecology and frequency. A form to be met with in shady places on smooth bark, rare.

Gelderland: Hierden, Hulshorst, 5 IV 1942, *Maas G. 1794* (L).

Sectio 6. AMPHYGYMNIA Vain.

in Act. Soc. F. Fl. Fenn., vol. 7, 1890, pars 1, p. 28; A. Zahlbr. in Engler-Prantl, Die natürl. Pflanzenfam., vol. 1, pars 1*, 1907, p. 213 — *Parmelia* subgen. *Euparmelia* sect. *Amphigymnia* A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 223 et vol. 10, 1940, p. 504 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 234.

Thallus foliaceous, more or less loosely adhering. Upper surface of the lobes grey or yellow-green in various shades. Lower surface rhizinose, but with a broad, bare, smooth zone at the tips. Lobes sometimes with ciliate margins. *Apothecia* eventually shortly pedicellate.

Key to the subsections.

1a. Upper surface yellow-green in various shades
subsect. 1. Subflavescentes
1b. Upper surface grey or grey-green in various shades
subsect. 2. Subglaucescentes

Remarks. It should be borne in mind that some forms of *Parmelia caperata* and *P. andreana* which belong to the *Subflavescentes* are distinctly grey-green.

Subsectio 1. Subflavescentes Vain.

in Act. Soc. F. Fl. Fenn., vol. 7, 1890, pars 1, p. 35; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 234; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 504 (ubi synon.).

Upper side of the thallus yellowish or yellow-green.

Key to the species.

1a. Thallus without pseudocyphellae. Medulla C — . . . 24. **P. caperata** (L.) Ach.
1b. Thallus pseudocyphellate. Medulla C + red . . . 25. **P. andreana** Müll. Arg.

24. Parmelia caperata (L.) Ach., Meth. Lich., 1803, p. 216; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 127; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 226; vol. 8, 1932, p. 555 et vol. 10, 1940, p. 508 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 234 — *Lichen caperatus* L., Spec. Pl., vol. 2, 1753, p. 1147 — *Imbricaria caperata* D.C. in Lam. et De Cand., Fl. Franç., ed. 3, vol. 2, 1805, p. 392; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 19.

Macroscopical description. Thallus foliaceous, medium-sized to large, up to 20 cm in diam., growing in rosettes, fixed to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, 1—4 cm long, 2—10 mm broad, more or less wavy to strongly folded, contiguous, overlapping or imbricate, irregularly or pinnately branched or incised. Margins flat to strongly raised, particularly in the centre of the thallus, not infrequently also a narrow zone curved downwards (revolute), entire, irregularly crenate or minutely incised. Tips broadened, 5—15 mm, flat or raised, broadly rounded, entire, crenate or lobate. Upper side of the lobes yellow, yellow-green or grey-green, sometimes becoming somewhat blackish in the centre, entirely dull or with faintly shiny tips, smooth or uneven, towards the centre rapidly becoming wrinkled — sometimes distinctly transversely wrinkled —, with occasional cortical ruptures, varying from esorediate to strongly sorediose, without pseudocyphellae or marginal cilia. In some cases the wrinkles develop into small warts or larger isidia-like papillae. Soralia whitish or yellowish, laminal or submarginal, at first punctiform, later on somewhat increasing. Lower side of the lobes in the centre of the thallus black, dull or somewhat shiny, smooth or wrinkled, rhizinose, at the tips brown, shiny, smooth or slightly veined, with a broad bare zone. Rhizinae black, rather short, simple, towards the tips of the lobes passing into minute warts. *Microscopical description.* Upper cortex colourless, with a yellowish exterior zone, paraplectenchymatous, 9—15 (—18) μ. Gonidia bright green, spherical, 6—14 μ, arranged in a layer of 30—60 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 100—180 μ, consisting of leptodermatous hyphae. Lower cortex black-brown, paraplectenchymatous, 15—20 μ. From the environs of Domburg (Island of Walcheren) a specimen of var. *cylisphora* was collected by Van den Bosch, possessing a few apothecia. *Apothecia* sessile, cup-shaped, up to 3 mm in diam. Amphithecium completely sorediate. Disc brown, dull. *Pycnidia* not observed.

Chemical constituents and reactions. Upper cortex K + yellow-brown, C —, KC + yellow-brown, Pd + dirty orange. Medulla K + persistently yellow or turning red-brown, C —, KC + pink or orange to red-brown, Pd + orange changing into minium-red (just as the soralia). Caperatic acid ($C_{22}H_{38}O_8$), caperin ($[C_{12}H_{20}O]3$), caperidin ($[C_{12}H_{20}O]2$), usnic acid ($C_{18}H_{16}O_7$), and capraric acid ($C_{24}H_{20}O_{12}$) are reported to occur in *Parmelia caperata* (Zopf, Flechtenstoffe, 1907, p. 36, 58, 61, 104, 189, 416). Asahina and Yanagita (in Ber. Deutsch. Chem. Ges., vol. 66 B, 1933, p. 1217—1220) proved that capraric acid is identical with protocetraric acid ($C_{18}H_{14}O_9$), the bitter compound which accounts for the coloration of the medulla when treated with Pd. Asano and Ohta corrected the formula of caperatic acid in that they found the formula $C_{21}H_{38}O_7$ (in Ber. Deutsch. Chem. Ges., vol. 66 B, 1933, p. 1020—1023).

Distribution. The species is common in the greater part of Europe, but it is rare in Scandinavia, whereas it seems to be lacking in Finland and the Baltics.

Remarks. Of all the varieties and forms known in literature, there are only a few represented in Holland, viz. var. *rugosa* and var. *cylisphora*, each with two forms. The distinguishing mark between both varieties is in the soralia, which are absent or almost so in var. *rugosa*, and abundant and frequently confluent in var. *cylisphora*. Intergradations are, of course, numerous. In the former, we may, according to the colour of the upper side, discriminate between f. *eu-rugosa* (yellow-green) and f. *subglauca* (grey-green), whereas in the latter a difference is made between plants bearing soralia only (f. *eu-cylisphora*), and those showing secondary laciniae in addition to the soralia (f. *ornata*).

Small specimens which in all proportions are more delicate than f. *eu-rugosa* might be called f. *delicata* Mereschk. (in Ann. Conserv. Jard. Bot. Genève, vol. 21, 1919, p. 199). The co-type, however, which has been distributed in Mereschk., Lich. Ticinens., no. 80 convinces me that such forms based on the size only are of little taxonomic value, as they may represent stages hampered in their growth.

As stated by Berry (in Ann. Missouri Bot. Garden, vol. 28, 1941, p. 33) of *caperata* (and some other species), this species "requires full sunlight ..." and is "never seen in vigorous condition in shade or in subdued light". Apparently, *Parmelia caperata* (or rather its var. *cylisphora*) behaves differently in Europe, for I have seen and collected specimens growing in shady places and attaining a diameter of as much as 15 cm. If in Holland *caperata* is found to be smaller — and so it is in most cases — I am inclined to hold drought responsible for the size.

Key to the varieties and forms.

1a. Upper side of the thallus yellow-green 2
  2a. Lobes strongly sorediate 3
    3a. Lobes with soralia only var. **cylisphora** Ach. f. **eu-cylisphora** Maas G.
    3b. Lobes also with strongly developed warts some of which grow out into secondary folioles . . . var. **cylisphora** Ach. f. **ornata** Maas G.

2b. Lobes esorediate or with a few soralia only
var. **rugosa** (Wallr.) Maas G. f. **eu-rugosa** Maas G.

1b. Upper side of the thallus grey-green
var. **rugosa** (Wallr.) Maas G. f. **subglauca** (Nyl.) Harm.

var. **rugosa** (Wallr.) Maas G. nov. comb. — *Parmelia centrifuga* var. *rugosa* Wallr., Fl. Cryptog. German., vol. 1, 1831, p. 498.

Lobes either esorediate or with a few soralia. Medulla K + persistently yellow.

var. **rugosa** f. **eu-rugosa** Maas G. nov. f.

Typus: the same as of *Lichen caperatus*.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 24, fig. 7, 8; Degel. in Svensk Bot. Tidskr., vol. 26, 1932, p. 334, fig. 1; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 37; Gams in Karsten et Walter, Vegetationsbilder, vol. 25, pars 1, 1936, tab. 3, fig. b (transition to var. *cylisphora*); Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 22, fig. 1; Schaer., Enum. Crit. Lich. Europ., 1850, tab. 3, fig. 2; Smith et Sowerb., Engl. Bot., vol. 10, 1800, tab. 654; Stein. in Jahresh. Ver. Vaterl. Naturk. Württemberg, vol. 94, 1938, p. 165, fig. 1; Wulf. in Jacquin, Collect. Bot., vol. 4, 1790, tab. 20, fig. 1.

Lobi 1—4 cm longi, 4—10 mm lati, apicibus 10—15 mm lati, contigui vel marginibus tegentes, superne flavi vel flavo-virentes, rugis hinc inde in papillas verrucosas mutantibus muniti.

Lobes 1—4 cm long, 4—10 mm broad, at the tips broadened up to 10—15 mm, contiguous or overlapping at the margins. Upper side yellow or yellow-green, wrinkles occasionally developing into wart-like papillae.

Ecology and frequency. On deciduous trees, usually at the base of the trunks, more rarely on conifers, over mosses as well as on boulders, somewhat rare, stages approaching var. *cylisphora* being far more common.

Remarks. Not infrequently the margins of the lobes in the centre of the thallus are cut into small crenulate lobules.

Apart from *P. andreana*, a rare species only to be found in the south of the province of Limburg, *P. caperata* is the sole yellow-green species among the arboricolous *Parmeliae* in Holland, so that confusion with other species is not to be feared. For the difference between the saxicolous forms of *caperata* and the *Xanthoparmeliae*, see under *P. conspersa*.

Drente: Hoogeveen, Kremboong, 29 VIII 1932, *Lütjeharms 68a* (L); Zuidlaren, XI 1859, *Acker Stratingh* (Gro).

Overijsel: Dalfsen, IV 1911, *Lako* (L); Denekamp, Brekelenkamp, VII 1831, *Dassen*, transition to var. *cylisphora* f. *eu-cylisphora* (NBV); Zalk, XI 1846, *Bondam* (NBV).

Gelderland: Bennekom, *Buse & Buse-Koppiers*, transition to var. *cylisphora* f. *eu-cylisphora* (NBV); Garderen, Solsche Gat, 28 IV 1919, *Ten Kate*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Hoog Keppel, Ulenpas, 13 VI 1943, *Maas G. 2566* (L); Nijkerk, III 1866, *Stolz* (L); 21 IV 1866, *Bondam* (L); Nijmegen, VIII 1890, *Top* (L); Putten, Putter bosch, 2 VI 1868, *Nijland*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Ubbergen, 1850, *Abeleven* (NBV); Velp, V 1849, transition to var. *cylisphora* f. *eu-cylisphora* (L); Warnsveld, 28 XII 1929, *Wassink 3363* (Wask).

Utrecht: Baarn, 16 V 1887, *Wakker*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Baarn, Soestdijk, VIII 1873, *Oudemans* (Gro, L, NBV, U); Bilthoven, De Lijen, 18 II 1941, *Stafleu* (U); Doorn, 19 IV 1941, *Maas G. 687* (L); Huis ter Heide, 19 VII 1859, *Van Hall* (NBV); Leersum, Darthuizen, VIII 1838, 23 VIII 1843, *Van Hall*

(NBV); Utrecht, IV 1841, *Van der Sande Lacoste* (NBV); Zeist, VIII 1847, *Top* (NBV).

Noord-Holland: Aerdenhout, 1837, *Molkenboer* (NBV); Alkmaar-Heiloo, 16 IX 1943, *Barkman 590* (L); Bergen, 16 XI 1940, *Maas G. 202* (L); 16 XI 1940, *Maas G. 200, 226*, transition to f. *subglauca* (L); Haarlem, *Splitgerber* (L); 1838, *Buse & Gildemeester-Buse*, transition to var. *cylisphora* f. *eu-cylisphora* (L, NBV); Haarlem, Haarlemmerhout, VII 1839, *Buse & Gildemeester-Buse* (NBV); Texel, De Dennen, 14 V 1942, *Stafleu*, transition to var. *cylisphora* f. *eu-cylisphora* (U).

Zuid-Holland: Lisse, Keukenhof, 9 III 1942, *Van Rossem 97* (L); 11 VI 1942, *Van Rossem 157* (L); Wassenaar, 18 X 1940, *Maas G. 35*, transition to f. *subglauca* (L); Wassenaar, Meiendel, 26 III 1941, *Maas G. 602*, transition to var. *cylisphora* f. *ornata* (L); 5 VII 1941, *Stafleu*, transition to var. *cylisphora* f. *eu-cylisphora* (U); 15 III 1942, *Van Rossem 80b*, transition to f. *subglauca* (L); 10 V 1942, *Van Rossem 139*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Wassenaar, de Pauw, 22 IV 1945, *Van Soest 953* (VS); Wassenaar, Raaphorst, XI 1944, *Van Soest 954* (VS); Wassenaar, Waalsdorp, 16 VI 1936, *Groot & Van Soest 122* (VS).

Noord-Brabant: Bergen op Zoom-Woensdrecht, 11 XI 1943, *Maas G. 2895*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Heeswijk, 11 IX 1934, *Nannenga 498* (Nga).

Limburg: Maastricht, *Franquinet* (L).

var. **rugosa** f. **subglauca** (Nyl.) Harm., Lich. France, vol. 4, 1909, p. 574; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 239; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 508 — *Parmelia caperata* subsp. *subglauca* Nyl. apud Gasil. in Journ. de Bot., vol. 8, 1894, p. 126 — *Parmelia caperata* var. *subglauca* Nyl., Lich. Envir. Paris, 1896, p. 35; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 232 (ubi lit.).

Upper side of the thallus grey-green. Medulla KC — or + pink.

Ecology. In shady places.

Remarks. In the original description nothing is said about the occurrence of soralia, but it may be taken for granted that there are only a few soralia or none at all, just like in f. *eu-rugosa*.

Stages transitional between f. *subglauca* and var. *cylisphora* are common, rather more so than typical *subglauca*.

Overijsel: Zwolle, I 1909, *Lako*, transition to var. *cylisphora* f. *eu-cylisphora* (NBV).

Gelderland: Elspeet, Elspeeter bosch, 27 X 1941, *Maas G. 1721* (L); Hierden, Hulshorst, 24 X 1941, *Maas G. 1565*, transition to var. *cylisphora* f. *eu-cylisphora* (L); 25 X 1941, *Maas G. 1593*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Leuvenum, Leuvenumsche bosch, 26 X 1941, *Maas G. 1670* (L).

Utrecht: Baarn, Groeneveld, 7 II 1943, *Maas G. 2256, 2262*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Doorn, 20 IV 1941, *Maas G. 703*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Utrecht, Rijnauwen, 28 VI 1933, *Nannenga 44a* (Nga); De Vuursche, Lage Vuursche, 15 II 1941, *Nannenga 1115* (Nga).

Noord-Holland: Bergen, 17 IX 1940, *Maas G. 226* (L); 17 IX 1940, *Maas G. 228*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Vogelenzang, 12 V 1947, *Maas G. 3696*, transition to var. *cylisphora* f. *eu-cylisphora* (L).

Zuid-Holland: Wassenaar, Meiendel, 2 XI 1941, *Maas G. 1771*, transition to var. *cylisphora* f. *eu-cylisphora* (L).

Zeeland: Walcheren, Vrouwenpolder, 1 X 1941, *Brakman*, transition to var. *cylisphora* f. *eu-cylisphora* (L); Zuid Beveland, 12 XI 1943, *Maas G. 2931* (L).

Limburg: Epen, Eperheide, 28 VII 1943, *Barkman 809* (L).

var. **cylisphora** Ach., Synops. Lich., 1814, p. 196; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 239; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 508.

Upper side of the lobes strongly sorediate, sometimes also papillate. Soralia for the greater part starting from the crests of the wrinkles or the papillae, sometimes crateriform. Soredia coarse-grained. Medulla K + persistently yellow.

var. **cylisphora** f. **eu-cylisphora** Maas G. nov. f.

Typus: the same as of *Parmelia caperata* var. *cylisphora.*

Soralia saepe confluentia, praecipue in centro thalli.

Soralia frequently coalescing, particularly in the centre of the thallus.

Ecology and frequency. This form seems to be restricted to more or less moist habitats, being usually found at the base of tree trunks in or at the outskirts of open woods. It is the most common form of *Parmelia caperata* in this country.

Remarks. From the original description it is not evident that *cylisphora* is the strongly sorediate variety of *caperata*; one would rather think of the reverse. The modern conception, however, is due to Gyelnik who studied the Acharian type in Helsinki, and published his notes in Mag. Bot. Lapok, vol. 28, (1929) 1930, p. 58.

It may be observed that the soralia often look isidioid (soralia isidialia).

Groningen: Groningen, III 1855, *Acker Stratingh* (NBV); Groningen, Sterrebosch, 1 I 1857, *Acker Stratingh* (Gro); Ter Apel, 1 VIII 1837, *Van Hall* (NBV); 13 XII 1906, 1 II 1907, *Tresling* (TA); 13 XII 1906, 6 I 1907, *Tresling,* transition to var. *rugosa* f. *subglauca* (TA).

Drente: Ansen, 2 VII 1941, *Maas G. 1521* (L); Hoogeveen, Kremboong, 29 VIII 1932, *Lütjeharms* (L); Paterswolde, *Acker Stratingh* (Gro); Valthe, 7 V 1941, *Maas G. 1066* (L); Weerdinge, *Van Hall* (NBV).

Overijsel: Dalfsen, XI 1912, *Lako* (L); XI 1912, *Lako,* transition to f. *ornata* (NBV); Deventer, *Top* (NBV); Diepenheim, 19 VII 1941, *Maas G. 1149* (L); Heino, XI 1908, *Lako* (L); II 1909, *Lako* (L, NBV); Ittersum, XII 1908, *Lako* (L); Kampen, VIII 1889, *Top* (NBV); Olst, IV 1909, *Lako* (L, NBV); Wijhe, II 1909, *Lako* (L); X 1912, *Lako* (L, NBV); IJselmuiden, Oosterholt, *Top* (L); IJselmuiden, Zandberg, IX 1889, *Top* (L); Zwolle, 24 III 1867, *Van Hall* (NBV); I 1909, *Lako* (L); Zwolle, Katerveer, V 1889, *Top* (L).

Gelderland: Apeldoorn, 't Loo, 1 VI 1852, *Van Hall* (NBV); Beek, 16 IV 1810, *Van Hall* (NBV); Beuningen, VIII 1849, *Abeleven* (NBV); Ede, *Buse* (NBV); Ellekom, VII 1891, *Top* (L); Garderen, 4 I 1940, *Stafleu* (U); Harderwijk, *Bondam* (NBV); Hattem, *Bondam* (L, NBV); Hattem, Trijsberg, 1889, *Top* (L); IX 1889, *Top,* transition to f. *ornata* (L); Hierden, Hoophuizen, 24 X 1941, *Maas G. 1575* (L); Nijkerk, 23 II 1866, *Bondam* (L); Nijmegen, VII 1846, *Abeleven* (NBV); III 1850, *Abeleven* (L, NBV); III 1850, *Abeleven,* transition to f. *ornata* (NBV); Nijmegen, Meerwijk, VIII 1849, *Abeleven* (NBV); Oldebroek, 23 X 1940, Miss *Caudri* (L); Renkum, VII 1849, *Buse & Buse-Koppiers,* c. ap. minut. (NBV); Twello, *Bondam* (NBV); *Top* (L); Ubbergen, 1850, *Abeleven* (L, NBV); Warnsveld, VIII 1845, *De Vriese* (NBV); 28 XII 1929, *Wassink 3374* (Wask).

Utrecht: Amersfoort, *Bondam* (NBV); Baarn, 2 IV 1944, *Agsteribbe* (L); Baarn, Soestdijk, 2 II 1920, *Hart de Ruyter* (U); de Bilt-Utrecht, 20 IX 1942, *Van Rossem 324* (L); Breukelen-Maarssen, 6 VIII 1943, *Maas G. 2705* (L); Bunnik-Utrecht, IV 1869, *Beinz* (L); Leersum, 26 X 1940, *Maas G. 71* (L); Odijk, 26 I 1941, *Stafleu* (U); Utrecht, *Van Hall* (NBV); IX 1837, *Wttewaal* (NBV); 17 V 1930, *Wassink 422* (Wask); Utrecht, Rijnauwen, 28 VI 1933, *Nannenga 44* (Nga); Zeist, *Molkenboer* (L).

Noord-Holland: Aerdenhout, 28 VI 1942, *Maas G. 1969* (L); Amsterdam, Rustenburgerpad, XII 1848, *Van der Sande Lacoste* (L); Amsterdam, Verwerspad, I 1849, *Van der Sande Lacoste* (L, NBV); Bennebroek, VII 1840, *Buse & Gildemeester-Buse* (NBV); Bergen, 16 XI 1940, *Maas G. 207* (L); 17 XI 1940, *Maas G. 228* (L); Haarlem, *Splitgerber,* transition to f. *ornata* (L); 1838, *Buse & Gildemeester-Buse* (NBV); 1 VI 1854, *Van Hall* (NBV); V 1870, *Oudemans* (Gro); Haarlem, Haarlemmerhout, 22 VII 1857, *Van Hall* (NBV); Heiloo, 15 V 1842, *Stafleu* (U); Overveen, 1841, *Buse & Gildemeester-Buse* (NBV).

Zuid-Holland: Dordrecht, *Van der Sande Lacoste* (NBV); 's Gravenhage, *Vrijdag Zijnen* (NBV); 's Gravenhage-Leiden, *Perein* (NBV); Leiden, *Molkenboer* (L, NBV); Lisse, 9 III 1942, *Van Rossem* (L); Lisse, Keukenhof, 11 VI 1942, *Van Rossem 159, 163* (L); Loosduinen, *Top* (NBV); Oegstgeest, Endegeest, *Schuurmans Stekhoven* (NBV); Rijnsburg, *De Haan* (L); Rijswijk, Overvoorde, 12 IV 1939, *Wachter* (L);

Vianen, VIII 1830, *Van Hall*, transition to f. *ornata* (NBV); Wassenaar, VII 1839, *Buse* (NBV); XII 1912, *Ten Kate* (L); IV 1919, *Florschütz* (U); Wassenaar, Duinrel, 7 IX 1941, *Maas G. 1424b* (L); Wassenaar, Meiendel, 21 VI 1939, *Groot & Van Soest 315* (VS); 2 XI 1941, *Maas G. 1764*, transition to f. *subglauca* (L); 12 X 1941, *Maas G. 1532*, transition to f. *ornata* (L); 10 V 1942, *Van Rossem 133* (L).

Zeeland: Walcheren, Domburg, IX 1841, *Van den Bosch*, transition to f. *ornata*, c. ap. (NBV); Walcheren, Oostkapelle, *Frederiks* (L); 1877, *Lako* (L); Walcheren, Souburg, I 1909, *Lako* (L); Zuid Beveland, *Van den Bosch*, transition to f. *ornata* (L); 1840—1842, *Van den Bosch* (NBV).

Noord-Brabant: Bergen op Zoom-Woensdrecht, 11 XI 1943, *Maas G. 2898* (L); Boxtel, IV 1924, *Smelt* (VD Wijk); Breda, Liesbosch, 26 III 1928, *Van Ooststroom* (Wask); Oirschot, 21 VIII 1941, *Wachter* (L); Rosmalen, 22 IX 1933, *Nannenga 374* (Nga).

Limburg: Maastricht, *Franquinet* (Maastr).

var. **cylisphora** f. **ornata** Maas G. nov. f.

Typus: Doornspijk, 25 IV 1942, *Maas G. 1821* (L).

Papillae praecipue in centro thalli vigentes, pro parte in soredia convertentes, pro parte etiam in foliola marginibus integris vel crenatis mutantes.

Papillae, particularly those in the centre of the thallus, strongly developed, partly bursting at their apex and becoming sorediose, partly growing out into folioles which have entire or crenate margins.

Drente: Paterswolde, 4 V 1900, *Van Harreveld* (Gro).

Overijsel: Zwolle, Zalne, XI 1912, *Lako* (L).

Gelderland: Doornspijk, 25 IV 1942, *Maas G. 1821*, type specimen (L); Ede, 11 IV 1941, *Maas G. 639* (L).

Zuid-Holland: Wassenaar, Duinrel, 7 IX 1941, *Maas G. 1424a* (L); Wassenaar, Meiendel, 10 V 1942, *Van Rossem 149* (L).

Limburg: Mook, St. Jansberg, 8 IV 1942, *Stafleu* (U).

25. Parmelia andreana Müll. Arg. in Rev. Mycol., vol. 1, 1879, p. 169; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 224 — *Parmelia kernstockii* Lynge et A. Zahlbr., in Ann. K. K. Naturh. Hofmus. Wien, vol. 27, 1913, p. 271; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 141 et vol. 10, 1940, p. 523 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 241.

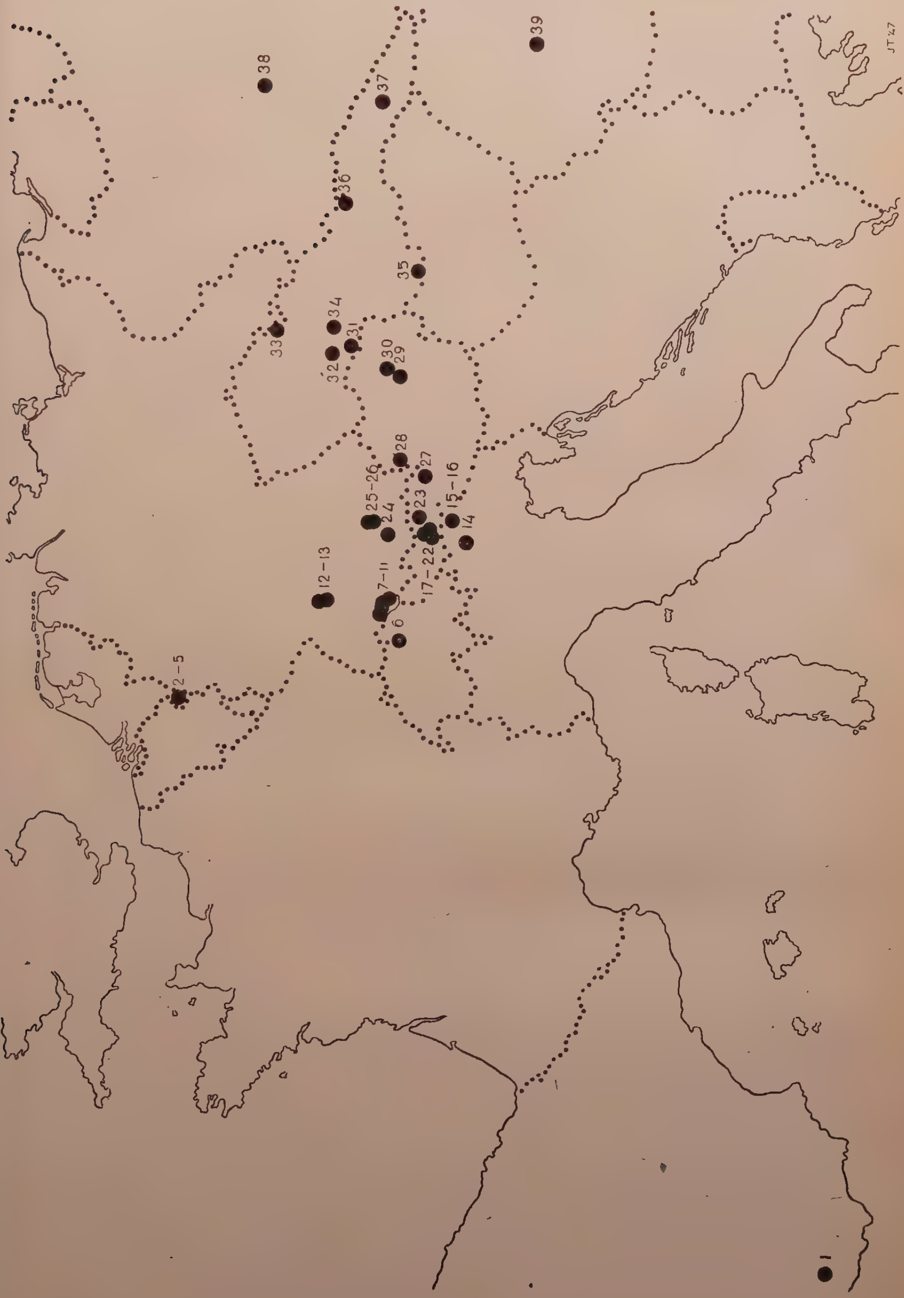
Macroscopical description. Thallus foliaceous, medium-sized, about 6—8 cm in diam., growing in rosettes, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, 1—2 cm long, 2—5 mm broad, more or less wavy, contiguous or overlapping, irregularly incised. Margins flat or raised, entire to irregularly crenate. Tips broadened, 6—8 mm, flat or raised, broadly rounded, entire, lobate or crenate. Upper side of the lobes yellow-green or grey-green, blackening towards the centre of the thallus, entirely dull, smooth to distinctly reticulately dented at the tips, becoming increasingly wrinkled towards the centre, with occasional cortical cracks, without marginal cilia, pseudocyphellate as well as sorediate. Pseudocyphellae whitish, irregularly shaped, occurring at the tips of the lobes, frequently bounding the indentures, towards the centre of the thallus gradually passing into soralia. Soralia yellowish or whitish, laminal and marginal, punctiform, globular, coarse-grained. Lower side of the lobes black, dull, smooth or wrinkled and rhizinose in the centre of the thallus, pale brown, shiny and wrinkled or veined at the tips, with a broad, bare terminal zone which sometimes extends far back towards the centre. Rhizinae black, short, simple, passing into small warts towards the tips of the lobes. *Microscopical description.* Upper cortex colourless, with a yellow-brown exterior zone, paraplectenchymatous, (9—) 12—15 (—18) μ. Gonidia bright green, spherical, 6—14 μ, arranged in a layer of 30—60 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 70—130 μ, consisting of leptodermatous hyphae. Lower cortex brown, paraplectenchymatous, 10—15 μ. *Apothecia* and *pycnidia* not seen.

Chemical reactions. Upper cortex K — or + faintly yellow, C —, KC + yellow, Pd —. Medulla K —, C + red, KC + orange-red, Pd —.

Distribution. *Parmelia andreana* is a notable species both with regard to its world-wide distribution and to its alleged rarity in Europe. Considering that *P. kernstockii* has been "discovered" as late as 1913 (Lynge et A. Zahlbr. apud Zahlbr. in Ann. K. K. Naturh. Hofmus. Wien, vol. 27, 1913, p. 271), it has aroused a good deal of interest, and, without the slightest intention of being complete, one would be able to quote a considerable number of papers dealing with this species. In most of these papers the species is still known under the name of *Parmelia kernstockii*. The knowledge that *kernstockii* is synonymous with *andreana* we owe to Santesson (in Ark. f. Bot., vol. 31, 1944, no. 7, p. 19—21). The papers referred to above are Anders, Strauch- u. Laubfl. Mitteleurop., 1928, p. 164—165; Cretzoiu in Publ. Ref. Fl. Lichenol. Român. Bucuresti, 1935, no. 2, p. 2; idem in Rev. Bryol. Lichénol., n. s., vol. 9, 1936, p. 139—141; idem in Bull. Jard. Mus. Bot. Univ. Cluj, vol. 20, (1940) 1941, p. 103—104; Fries in Svensk Bot. Tidskr., vol. 32, 1938, p. 212—214; Gyelnik in Rep. spec. nov. regn. veg., vol. 29, 1931, p. 284; Hillmann in Rabenh. etc., 1936, p. 241—243; idem in Ber. Bayer. Bot. Ges., vol. 22, 1937, p. 132; Du Rietz in Bot. Notis., 1925, p. 2—4; Santesson in Ark. f. Bot., vol. 31, 1944, no. 7, p. 19—21; Steiner in Jahresh. Ver. Vaterl. Naturk. Württemberg, vol. 94,

Fig. 16 — Map showing the distribution of *Parmelia andreana* Müll. Arg. in Europe.

1. Granada, Sierra de Abdagalis
2. Epen
3. Epen, Diependaal
4. Kamerig
5. Wijlre, Beertsenhoven
6. Zürich
7. Baden, Mainau
8. Eriskirch
9. Langenargen
10. Enzisweiler
11. Bad Schachen
12. Holzmaden (Kreis Kirchheim a. d. Teck)
13. Strümpfelbach (Waiblingen)
14. Lengmoos — Klobenstein
15. Ehrenburg (Pustertal)
16. Issing
17. Steinach
18. Steinach — Nösslach
19. Steinach — Plon
20. Steinach — Siegreith
21. Gschnitz
22. Patsch (Wipptal)
23. Weerberg (Schwaz)
24. Seeshaupt, Bernriederfilz (Starnbergersee)
25. Schleissheim (München)
26. Feldmoching (München)
27. Harland, Waitzendorf
28. Zell am See (Salzburg)
29. Wiesenbachtal (Lilienfeld)
30. St. Pölten
31. Znaim
32. Trebitsch
33. Adlergebirge
34. Jundrow (Brünn)
35. Parkan, Hronská Kamenica, Kovačovske kopce
36. Valley of the Strazyska (Hohe Tatra)
37. Chlumec (Uzhorod)
38. Majdan Ruszowski
39. Sibiu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7–11
12–13
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15–16
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1938, p. 163—168, idem in Oesterreich. Bot. Zeitschr., vol. 88, 1939, p. 43—48.

Most of these papers deal with the distribution of the species, and it appears from those by Steiner that *P. andreana* is far less rare than was originally supposed. A survey of the European localities is given in the map (fig. 16) on which 5 new localities are entered, one from Switzerland and four close together from Holland. The Swiss specimen is f. *subglauca* M. Steiner, and was collected by me, June 14th, 1946, during a short stay in Zürich from a *Tilia* amidst houses in the south-western part of the town (it grew in company of *Parmelia scortea* [fine specimens], *P. dubia, P. exasperatula* [poor], *Physcia adscendens* [poor], *Ph. tenella* [poor], *Ph. grisea, Evernia prunastri* [poor], and *Candelariella* sp.).

f. **andreana** Maas G. nov. f.

Typus: the same as of *Parmelia andreana.*

Iconography: Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 242, fig. 14; Stein. in Jahresh. Ver. Vaterl. Naturk. Württemberg, vol. 94, 1938, p. 164, fig. 1.

Lobi supra flavo-virentes, subtus zona castanea lata, sed thalli centrum non attingente.

Upper side of the lobes yellow-green. Pale brown zone on the lower surface not extending as far as the centre of the thallus.

Ecology and frequency. On deciduous trees, very rare, as yet found in the southernmost part of the province of Limburg only.

Remarks. As to the colour of the upper side, the Dutch specimens are somewhat intermediate between f. *andreana* and f. *subglauca* M. Steiner (in Oesterreich. Bot. Zeitschr., vol. 88, 1939, p. 44), ranging between dirty yellow and grey-green. Perhaps the neighbourhood of the coal-mines with their fumes has something to do with this discolouration; at all events the plants lack the fresh grey-green colour I observed in the Swiss specimen of f. *subglauca.* Also the "zona castanea ad centrum fere pertinens" of the lower side, characteristic to f. *subglauca,* is not generally found in the Dutch material. I am inclined to hold these specimens for a stage transitional to f. *subglauca.*

Another feature to be mentioned is procured by the soralia, some of which, homologous with those of *Parmelia caperata* var. *cylisphora* f. *ornata,* are isidioid, while others grow out into secondary folioles. The material is, however, too scanty to create a new form.

Limburg: Epen, 15 VI 1941, *Stafleu* (U); Epen, Diependaal, 8 VI 1943, *Van Rossem* (L); Kamerig, 13 VII 1942, *Maas G. 2011* (L); Wijlre, Beertsenhoven, 9 VII 1942, *Van Rossem 214* (L).

Subsectio 2. Subglaucescentes Vain.

in Act. Soc. F. Fl. Fenn., vol. 7, 1890, pars 1, p. 28; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 243; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 504 (ubi synon.).

Upper side of the lobes (whitish,) grey or grey-green.

26. **Parmelia trichotera** Hue in Journ. de Bot., vol. 12, 1898, p. 245; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 220 et vol. 10, 1940, p. 538

(ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 248.

Nearly all of the finds quoted as *Parmelia perlata* by Van den Bosch (in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 123), and as *Imbricaria perlata* by Abeleven (in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 16) belong here.

Macroscopical description. Thallus foliaceous, medium-sized to large, up to 15 cm in diam., growing in rosettes or wide-spreading, more or less loosely adhering to partly ascendent, attached to the substratum by means of rhizinae, deeply incised. Lobes dorsiventrally flattened, 1—4 cm long, 4—10 mm broad, more or less strongly wavy, overlapping at the margins, irregularly incised or branched. Margins flat to undulate and raised, entire, minutely incised or irregularly lobate, sometimes partly sorediate, and sometimes ciliate. Tips broadened, up to 10—15 mm, usually raised, broadly rounded, entire, lobate or incised, sometimes sorediate or with black cilia. Upper side of the lobes grey or greenish grey, entirely dull, smooth, becoming more or less wrinkled towards the centre, with cortical cracks, without isidia or pseudocyphellae, either with or without soralia. Lower side of the lobes black, dull or somewhat shiny, smooth or wrinkled, and rhizinose in the centre of the thallus; brown, shiny, smooth or wrinkled and veined at the tips, with a broad, bare terminal zone, or with rhizinae almost reaching to the tips. Rhizinae black, short, simple, passing into warts towards the tips of the lobes. *Microscopical description.* Upper cortex colourless, with a yellowish exterior zone, paraplectenchymatous, 15—18 μ. Gonidia bright green, spherical, 6—15 μ, arranged in a layer of 20—30 μ. Medulla colourless, white in reflected light, densely plectenchymatous, 40—90 μ, composed of leptodermatous hyphae. Lower cortex black-brown, paraplectenchymatous 9—18 μ. *Apothecia* not observed. *Pycnidia* not common but sometimes numerous, laminal, visible as black dots near the tips of the lobes, immersed, spherical, 90—140 μ in diam. Perifulcrium colourless or yellowish, ostiolum black. Pycnoconidia colourless, cylindrical, straight, ± 1 × 5—7 μ.

Chemical reactions. Upper cortex K + yellow, C —, KC + orange-brown, Pd + orange. Medulla K + yellow, C — or + faintly yellow, KC + citrine, turning yellow-brown to orange-red, Pd + yellow, slowly turning orange-red, just like the soralia.

Distribution. As pointed out by Degelius (in Act. Phytogeogr. Suec., vol. 7, 1935, p. 204), *Parmelia trichotera* is a suboceanic lichen which has its main area in Central Europe and in Mediterraneous mountain regions. The species is lacking in Fennoskandia and the Baltics, and it has only recently been found in a few places in Denmark (Almborn in Bot. Notis., 1939, p. 775).

Remarks. It is noteworthy that neither Hillmann (l. c. p. 249) nor Tavares (in Portugal. Act. Biol., vol. 1B, 1945, p. 148) mention the discolouring of the medulla when treated with C and KC. Yet, nearly all of the exsiccata quoted by Hillmann, as well as the scanty material from Portugal extant in the Rijksherbarium clearly show a positive reaction.

Key to the forms.

1a. Thallus sorediate . . . . f. **trichotera** (Boist.) Maas G.
1b. Thallus esorediate. . . . . f. **munda** Harm.

f. **trichotera** (Boist.) Maas G. nov. comb. — *Parmelia perlata* subsp. *trichotera* Boist., Nouv. Fl. Lich., vol. 2, 1903, p. 61 (non vidi) — *Parmelia trichotera* var. *typica* DR. in Nyt Mag. Naturvidensk., vol. 62, 1925, p. 77.

Iconography: Tavares in Portugal. Act. Biol., vol. 1B, 1945, tab. 9, fig. 1; this paper fig. 17.

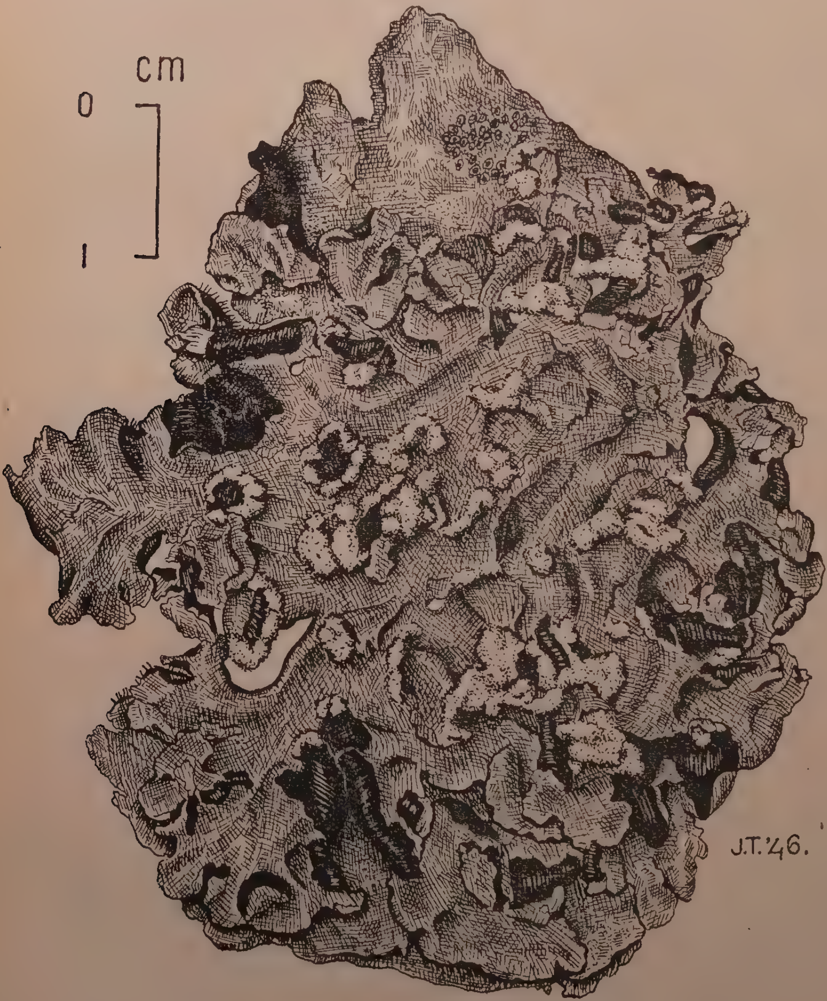

Fig. 17 — *Parmelia trichotera* Hue f. *trichotera* (Boist.) Maas G.

Lobes neither short nor crowded in the centre of the thallus, margins not minutely incised, partly sorediate. Soralia white, hemispherical, at first occurring near the margins and the tips of the lobes, subcapitiform, solitary or confluent, later on more sublimbiform.

Ecology and frequency. On deciduous and coniferous trees;

formerly fairly common as may be inferred from the herbarium material, but very rare in the present time.

Remarks. Du Rietz, whom we owe the unraveling of this and closely related species in the *perlata*-group, mentions that the margins of *P. trichotera* are always more or less ciliate. Also Degelius (in Göteborgs Kgl. Vetensk.-Vitterh. Samh. Handl., F. 6, ser. B, vol. 1, 1941, no. 7, p. 33) stresses the presence of marginal cilia, particularly in distinction to his *Parmelia robusta* which, as he puts it, "is distinguished from *P. trichotera* Hue ... by ... laciniae, almost without cilia in the margin...". Now, this is a feature not unknown in Dutch specimens of *trichotera*. Actually, plants with really well-developed cilia are rare in Holland. By the way, that these specimens do not belong to *P. robusta* Degel. may be inferred from the lobes which are not conspicuously rounded, from the abundance of rhizinae on the lower surface, and finally from the medulla which immediately takes on a deep yellow colour on appliance of K.

Groningen: Eelde, Oosterbroek, 14 VIII 1855, *Van Hall* (NBV); Groningen, 1831 (U); Groningen-Haren, *Acker Stratingh* (Gro); Haren, *Van Hall* (NBV); Haren, Harendermolen, *Acker Stratingh* (Gro); V 1839, *Van Hall* (NBV); Noordlaren, II 1856, *Acker Stratingh* (Gro).

Drente: Hoogeveen, Kremboong, 29 VIII 1932, *Lütjeharms 60* (L).

Overijsel: Goor, 8 VIII 1859, *Van Hall* (NBV); Kampen, *Top* (NBV); Vollenhove, 22 VII 1928, *Koopmans* (Koopm); Wijhe, II 1909, *Lako* (L); Zwolle, II 1909, *Lako* (L, NBV).

Gelderland: Beek, 10 XI 1871, *Van Hall* (L); Bennekom, 1840, *Buse & Gildemeester-Buse* (NBV); Borculo, VII 1859, unio NBV (NBV); Hattem, VI 1850, *Bondam* (L, NBV); Nijmegen, V 1880, *Abeleven* (NBV); Nijmegen, Berg en Dal, 2 I 1870, *Van Hall* (NBV); Nijmegen, Meerwijk, 13 VIII 1873, *Van Hall* (L); Renkum, *Buse & Buse-Koppiers* (NBV); Ubbergen, IV 1847, II 1880, *Abeleven* (NBV); Uddel, Uddelermeer, VIII 1849, unio NBV (L, NBV).

Utrecht: Baarn, VIII 1873, *Oudemans* (Gro); Baarn, Soestdijk, VIII 1873, *Oudemans* (Gro, L, NBV, U); de Bilt, V 1842, *Van der Sande Lacoste* (L, NBV); 1843, *Van der Sande Lacoste* (L); Huis ter Heide, 2 VII 1859, *Van Hall* (NBV); Leersum, Darthuizen, 10 VIII 1838, *Van Hall* (NBV); Utrecht, *Van der Sande Lacoste* (L); Zeist, *Molkenboer* (L, NBV).

Noord-Holland: Amsterdam, Zeeburg, III 1849, *Van der Sande Lacoste* (NBV); Haarlem, Haarlemmerhout, 19 VII 1854, *Van Hall* (NBV); 2 IX 1873, *Van Hall* (L); 21 VIII 1884, *Van Hall* (U).

Zuid-Holland: Koudekerk, IV 1877, *Lako* (L); Leiden, IX 1845, *De Vriese* (L); Naaldwijk, *Van der Trappen* (NBV); Vianen, VIII 1830, *Van Hall* (NBV); Voorschoten, *Gevers Deynoot* (L); Wassenaar, VII 1838, *Buse* (NBV); 21 I 1924, *Ten Kate* (L); Wassenaar, Meiendel, 15 III 1942, *Van Bossem 79* (L); De Zilk, 26 V 1947, *Barkman* (L).

Zeeland: Walcheren, Domburg, IX 1841, *Van den Bosch* (NBV); Walcheren, Middelburg, I 1909, *Lako* (L); Walcheren, Serooskerke, 18 IX 1935, *Wassink* (Nga); Walcheren, Souburg, I 1909, *Lako* (L); Zuid Beveland, 1841, *Van den Bosch* (NBV); Zuid Beveland, Goes, *Van den Bosch* (L).

Noord-Brabant: Breda, 1852, unio NBV (L).

Limburg: Maastricht, *Franquinet* (Maastr).

f. **munda** Harm., Lich. France, vol. 4, 1909, p. 582; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 221 et vol. 10, 1940, p. 538 (ubi lit.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl, ed. 2, vol. 9, pars 5/3, 1936, p. 249.

Thallus esorediate.

Gelderland: Beek, 16 IV 1870, *Van Hall* (NBV); Bennekom, 1840, *Buse & Gildemeester-Buse* (NBV).

Utrecht: Huis ter Heide, 2 VII 1859, *Van Hall* (NBV).

Zuid-Holland: 's Gravenhage, Haagsche bosch, 25 VII 1854, *Van Hall* (NBV); Naaldwijk, *Van der Trappen* (NBV).

Zeeland: Zuid Beveland, *Van den Bosch*, transition to f. *trichotera* (L, NBV); Zuid Beveland, Wemeldinge, 1844, *Van den Bosch* (NBV).

4. **CETRARIA** Ach.,

Meth. Lich., 1803, p. 292; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 121; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 12; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 279 et vol. 10, 1940, p. 542 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 254.

Thallus foliaceous or fruticose, loosely adhering or ascending to upright, either fixed to the substratum by means of scattered rhizinae or not, incised. Lobes dorsiventrally flattened or almost isolateral, frequently more or less canaliculate, stratified, corticated. Upper cortex usually paraplectenchymatous or divided into two zones. The upper one paraplectenchymatous, originated from short-celled septate hyphae perpendicular to the surface, the lower one scleroplectenchymatous, composed of anastomosing and septate hyphae parallel to the surface. Gonidia bright green (*Chlorococcum* Fr.), arranged in a layer below the upper cortex. Medulla plectenchymatous, white or yellow. Lower cortex scleroplectenchymatous or paraplectenchymatous, sometimes pseudocyphellate. *Apothecia* marginal or nearly so, attached more or less obliquely, sessile, mostly on the upper side, more rarely on the lower side, saucer-shaped, lecanoroid. Hypothecium colourless, sometimes with gonidia underneath. Asci 6—8-spored. Spores 1-celled, colourless, somewhat small, ellipsoidal or spherical, thin-walled, more rarely thick-walled. *Pycnides* usually marginal and immersed in papillae or spines, thus looking pedicellate, brown or blackish. Fulcra endobasidial. Pycnoconidia straight, ellipsoidal, clavate or cylindrical, or constricted in the middle (description partly after Hillmann, l. c.).

There are 4 species in Holland.

Artificial key to the species.

1a. Arboricolous species, without pseudocyphellae 2
2a. Medulla white 3
3a. Lower side of the thallus darker in the centre than at the periphery **1. C. glauca** (L.) Ach.
3b. Lower side paler in the centre than at the periphery **2. C. chlorophylla** (Willd.) Vain.
2b. Medulla yellow, as are the soralia . . . **3. C. pinastri** (Scop.) S. Gray
1b. Terricolous species, pseudocyphellate . . . . . . **4. C. islandica** (L.) Ach.

Key to the sections.

1a. Thallus foliaceous. Lobes loosely attached, flat or somewhat wavy, with ascending margins. Arboricolous or saxicolous . . . . sect. 1. Platysma
1b. Thallus fruticose, ascending or erect, stiff and cartilaginous. Lobes more or less canaliculate. Terricolous . . . . sect. 2. Eucetraria

Sectio 1. PLATYSMA (Hoffm.) Körb.

Parerg. Lichenol., 1865, p. 18; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 282 et vol. 10, 1940, p. 543 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 256 — *Platisma* Hoffm. apud Ach. in Kgl. Vetensk. Acad. Nya Handl., vol. 15, 1794, p. 252.

Thallus foliaceous, rarely growing in rosettes, usually loosely adhering to the substratum. Lobes ascending or at least the margins so. Usually arboricolous or saxicolous.

Key to the subsections.

1a. Upper side of the thallus showing no yellow colours. Medulla white subsect. 1. Glaucescentes
1b. Upper side tinged with yellow. Medulla white or yellow subsect. 2. Flavescentes

Subsectio 1. Glaucescentes Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 256; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 543.

Upper side of the thallus showing all shades of glaucous, grey, grey-green, whitish or brownish.

Key to the species.

1a. Lower side of the thallus in the centre darker than at the periphery. Upper side J + violet. Upper cortex palisadeplectenchymatous **1. C. glauca** (L.) Ach.
1b. Lower side of the thallus in the centre paler than at the periphery. Upper side J —. Upper cortex paraplectenchymatous **2. C. chlorophylla** (Willd.) Vain.

1. Cetraria glauca (L.) Ach., Meth. Lich., 1803, p. 296; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 121; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 12; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 291; vol. 8, 1932, p. 570 et vol. 10, 1940, p. 544 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl., Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 257 — *Lichen glaucus* L., Spec. Pl., vol. 2, 1753, p. 1148.

Macroscopical description. Thallus foliaceous, lobes gracefully ascending or loosely adhering to the substratum, fixed to it by a few rhizinae, more or less deeply incised. Lobes somewhat thin, cartilaginous, extremely varying in form and size, 1—4 cm long, 0.5—2 cm broad, discrete or overlapping, wavy, irregularly incised or branched, sometimes blistered at the margins. Margins more or less undulate or crispate, usually ascendent, entire, irregularly crenate or lacerated into long isidial outgrowths, sometimes also strongly servediose. Tips usually broadened and fan-shaped, crenate, lobate or incised. Upper side of the lobes bluish green, grey-green, brownish green or dark brown, more or less shiny, smooth or reticulately dented, with cortical cracks, isidiate and sorediate, or sorediate only. Isidia rarely laminal, usually marginal, 0.5—10 mm long, more or less coralloid or elongate and much branched, sometimes developing into folioles or becoming servediose. Soralia laminal and marginal, the former punctiform or maculiform, small and rarely confluent, the marginal ones, originated from isidia, more or less confluent, sometimes forming a continuous sorediose fringe. Lower side either black in the centre of the thallus, turning dark or pale brown towards the tips, or entirely white, or blotted black and white, more or less shiny, clearly reticulately veined or partly smooth, with a few scattered, black, simple rhizinae. *Microscopical description.* Upper cortex colourless, palisadeplectenchymatous, 15—25 μ. Gonidia bright green, spherical, 6—12 μ, arranged in clusters of 15—30 μ. Medulla colourless, white in reflected light, more or less densely plectenchymatous, consisting of pachydermatous hyphae. Lower cortex dark brown, paraplectenchymatous, 15—20 μ. *Apothecia* and *pycnids* not observed.

Chemical constituents and reactions. Upper cortex K — or + yellowish, C —, KC —, J + bluish violet, Pd + slowly yellow-green. Medulla J + bluish violet, otherwise indifferent. According to Zopf (Flechtenstoffe, 1907, p. 36, 226, 421), this species contains caperatic acid ($C_{22}H_{38}O_8$) and atranorin ($C_{19}H_{18}O_8$). As to the formula of the former, Asano and Ohta (in Ber. Deutsch. Chem. Ges., vol. 66B, 1933, p. 1020—1023) find the composition to be $C_{21}H_{38}O_7$. Against the find of atranorin there is the objection that this compound is known to react with a strong yellow colour upon K, a coloration which I have never observed in *Cetraria glauca.* The blue colour evoked by J is probably due to isolichenin ($C_6H_{10}O_5$).

Distribution. This species is known from all over Europe.

Remarks. A fair number of the forms described are represented in Holland. The variability touches upon the general habit of the plant (numerous, short, round, raised lobes in f. *crispata*; larger, less crowded lobes in f. *melanoplaca* and the others), upon the quality of the margins of the lobes (lacerated into long isidia in f. *coralloidea*; strongly sorediose in f. *ulophylla*; much less pronounced in the others), or upon the colour of the lower side (white in f. *fallax*; black in the others).

Cetraria glauca may easily be mistaken for some *Parmelia,* more particularly for a species of the *Amphigymnia*-group. A distinguishing mark which in most cases holds good is e. g. the scarcity of rhizinae in *C. glauca,* whereas the different reaction on appliance of J to the upper side never deceives. Yet, even without looking for any particular feature we may, with experience, learn and discriminate between *Parmelia* and *Cetraria.*

Key to the forms.

1a. Lower side of the thallus either pure white or mottled with black or brown **f. fallax** (Web.) Stein
1b. Lower side black, turning brown towards the tips of the lobes 2
2a. Margins of the lobes crispate, bordered with a swollen fringe of confluent soralia . . . . **f. ulophylla** (Wallr.) Körb.
2b. Soralia, if present, not confluent to such an extent that a sorediose border is formed 3
3a. Thallus orbicular. Lobes small, short, rotundate, ascendent **f. crispata** Hilitz.
3b. Thallus different from above 4
4a. Margins of the lobes lacerate, developed into richly and dendritically branched isidia or laciniae . . . **f. coralloidea** (Wallr.) Körb.
4b. Margins of the lobes isidiate. Isidia at most somewhat coralloid **f. melanoplaca** (Wallr.) Maas G.

f. **melanoplaca** (Wallr.) Maas G. nov. comb. — *Parmelia glauca* var. *melanoplaca* Wallr., Fl. Cryptog. German., vol. 1, 1831, p. 521.

Iconography. Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 26, fig. 7; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 14; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, fig. 17; Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 2, fig. 2: Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 24, fig. 5 (rather unrecognisable); Smith et Sowerb., Engl. Bot., vol. 23, 1806, tab. 1606; A. Zahlbr. in Engler-Prantl, Die natürl. Pflanzenfam., ed. 2, vol. 8, 1926, tab. 115, fig. A.

Margins of the lobes partly entire or irregularly crenate, partly isidiate. Upper side varying from bluish green or grey-green to brown-green. Isidia mostly marginal, up to 2 mm long, sometimes developing into folioles, usually bursting and becoming sorediose. Soredia thus formed partly confluent, though not forming a continuous, swollen sorediose fringe. Lower side black, turning brown towards the tips of the lobes.

Ecology and frequency. On deciduous trees, mainly birch and beech, especially when the bark is cracked and decaying, more rarely on conifers, also over mosses, on boulders or on the ground, even on sand in the dunes. *C. glauca* is a hygrophilous species which is not uncommon in the sheltered woody regions of Holland, but, on the contrary, almost completely wanting in the open wind-swept western provinces, except in the dunes where it may be found on the slopes facing north.

Remarks. I consider this form identical with the type of *Lichen glaucus*.

Drente: Dwingelo, 31 VII 1941, *Maas G. 1407* (L); 1 VIII 1941, *Maas G. 1453* (L); Emmen, Emmerveld, 8 V 1941, *Maas G. 1073* (L); Hoogeveen, 29 VIII 1932, *Lütjeharms 68c* (L); Hoogeveen, Kremboong, 9 VI 1933, *Van Ooststroom 5599a* (L); Midlaren-Zuidlaren, IV 1853, *Reilingh* (NBV); Peize, VIII 1855, *Acker Stratingh*, mixed with f. *ulophylla* (NBV); VIII 1855, *Acker Stratingh*, transition to f. *ulophylla* (Gro, L, NBV); Schipborg, 5 V 1941, *Maas G. 925* (L); Zuidlaren, XI 1856, *Acker Stratingh* (Gro); X 1858, *Acker Stratingh* (Gro, L, NBV).

Overijsel: Diepenheim, 19 VII 1941, *Maas G. 1150* (L); Goor, 25 VII 1941, *Maas G. 1274* (L); Lemele, Lemelerberg, 27 VII 1941, *Maas G. 1315* (L); Lemele-Dalfsen, 27 VII 1941, *Maas G. 1351a* (L).

Gelderland: Apeldoorn, 't Loo, 1 VIII 1854, *Van der Sande Lacoste* (NBV); Bennekom, Hullenberg, 6 IX 1942, *Maas G. 2211* (L); Bennekom, Oostereng-Quadenoord, 24 V 1943, *Maas G. 2480*, transition to f. *fallax* and f. *ulophylla* (L); Dieren, I 1920, *Keyzer & Florschütz* (U); Doetinchem, 10 IX 1935, *Nannenga 548* (Nga); Doornspijk, 25 IV 1942, *Maas G. 1836* (L); Doornspijk, Nieuw Soerel, III 1942, *Groot & Van Soest 641* (VS); IV 1942, *Maas G. & Van Soest 768, 769* (VS); Ede, 11 IV 1941, *Maas G. 643*, transition to f. *fallax* (L); Epe, VI 1942, Miss *Lusink* (L); Ellekom, Hagenau, 8 VIII 1942, *Van Rossem 267, 271* (L); 13 VI 1943, *Maas G. 2545* (L); Garderen, Speulder bosch, 4 I 1941, *Stafleu*, transition to f. *fallax* (U); Hierden, Hulshorst, 24 X 1941, *Maas G. 1557, 1587* (L); 25 X 1941, *Maas G. 1591*, transition to f. *fallax* (L); Hierden, Hulshorst, Poolsche weg, *Ten Kate*, transition to f. *ulophylla* (L); Hierden, Hulshorst-Staverden, 28 IV 1919, *Ten Kate* (L); Hoenderloo, 8 XI 1941, *Maas G. 158* (L); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2365* (L); Leuvenum, Leuvenumsche bosch, 26 X 1941, *Maas G. 1673* (L); 6 IV 1942, *Maas G. 1807*, transition to f. *fallax* (L); Nijmegen, Berg en Dal, 31 XII 1921, *Ten Kate* (L); Oldebroek, 19 VIII 1942, Miss *Lusink* (L); Otterloo, 26 III 1940, *Nannenga 1030* (Nga); Putten, Sollensche Gat, 5 I 1940, 30 XII 1941, *Stafleu* (U); Renkum, *Buse* (NBV); *Buse & Buse-Koppiers*, partly f. *ulophylla* (L); 1849, *Buse & Buse-Koppiers*, transition to f. *ulophylla* (L); Speulde, 28 V 1939, *Nannenga 813a* (Nga); Winterswijk, Bekkendelle, 14 X 1939, *Nannenga 1003* (Nga); 14 IV 1941, *Stafleu* (U); Wolfheze, 21 IV 1930, *Van Ooststroom 3074* (L); 25 X 1941, *Nannenga 1222* (Nga).

Utrecht: Baarn, Groeneveld, 7 II 1943, *Maas G. 2272* (L); De Bilt, 8 III 1930, *Wassink 234*, transition to f. *ulophylla* (Wask); De Bilt, Eyckestein, 15 II 1941, *Nannenga 1102* (Nga); De Vuursche, Lage Vuursche, 7 V 1939, *Nannenga 778a* (Nga); 9 IV 1944, *Agsteribbe* (L); De Vuursche-Hilversum, 28 II 1943, *Maas G. 2276* (L).

Noord-Holland: Terschelling, Boschplaat, 7 V 1946, *Westhoff 46118* (L).

Noord-Brabant: Baarschot, de Haardgang, 17 XI 1943, *Barkaman 686* (L); Boxtel-Best, Veldersbosch, 14 XI 1943, *Barkman 668* (L); Cromvoirt, 29 III 1903, *Wakker* (L); Heeswijk, 11 IX 1934, *Nannenga 504* (Nga); Oisterwijk, Gemullehoeken, 18 XI 1943, *Barkman 676* (L); Oisterwijk, Groot Speyck, 12 IX 1934, *Nannenga 507* (Nga); Oisterwijk, Witven, 15 XI 1943, *Barkman 673* (L); Vught, Loverensche ven, 2 XII 1906, *Wakker* (L).

f. **fallax** (Web.) Stein in Cohn, Kryptog.-Fl. Schles., vol. 2, pars 2, 1879, p. 64; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 297 et vol. 10, 1940, p. 545 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 260 — *Lichen fallax* Web., Spicil. Fl. Götting., 1778, p. 244 (non vidi).

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 26, fig. 8; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 254; Smith et Sowerb., Engl. Bot., vol. 33, 1812, tab. 2373 (rather a transition to f. *coralloidea*).

Lower side of the thallus white or at most blotted with black or brown spots.

Ecology and frequency. Restricted to an even moister habitat than f. *melanoplaca*, and therefore very rare in Holland. As a rule, stages approaching the last-named form are met with.

Remarks. Most authors ascribe the combination f. *fallax* to Acharius, but the latter distinctly speaks of a variety. As far as I could trace, Stein is the first author to write plainly forma.

Gelderland: Leuvenum, Leuvenumsche bosch, 6 IV 1942, *Maas G. 1806* (L); Voorst, XII 1919, *Hart de Ruyter*, partly transition to f. *melanoplaca* (U).

f. **crispata** Hilitz. in Ann. Mycol., vol. 22, 1924, p. 227; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 260; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 545 — *Cetraria glauca* f. *fusca* s. f. *crispata*; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 300.

Thallus orbicular. Lobes small, short, rotundate, ascending.

Utrecht: Leersum, 27 X 1940, *Maas G. 94* (L).

Noord-Brabant: Oisterwijk, Logtsche heide, 23 VII 1943, *Maas G. 2614* (L).

f. **ulophylla** (Wallr.) Körb., Syst. Lich. German., 1855, p. 46; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 300 et vol. 10, 1940, p. 545 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 260 — *Parmelia glauca* m. *ulophylla* Wallr., Fl. Cryptog. German., vol. 1, 1831, p. 522.

Margins ascending, crispate, almost completely fringed with a swollen border of confluent soralia. Laminal soralia frequent, and more or less confluent too.

Drente: Zuidlaren, X 1858, *Acker Stratingh* (L).

Gelderland: Apeldoorn, 't Loo, 1 VIII 1854, *Van der Sande Lacoste* (NBV); Doornspijk, Nieuw Soerel, 25 IV 1942, *Maas G. 1858* (L); Ede, Edesche bosch, *Buse* (L); Ellekom, Hagenau, 13 VI 1943, *Maas G. 2538* (L); Hoenderloo-Beekbergen, Spelderholt, 28 III 1943, *Maas G. 2378, 2381* (L); *Maas G. 2377*, transition to f. *coralloidea* (L);

Laag Soeren, 28 VIII 1941, *Van Ooststroom 7538* (L); Putten, Schovenhorst, 18 VII 1937, *Nannenga 658*, transition to f. *fallax* (Nga); 29 VI 1939, *Nannenga 880*, transition to f. *fallax* (Nga).

Utrecht: De Bilt, 14 I 1930, *Wassink 207* (Wask); 8 III 1930, *Wassink 218* (Wask); Maarsbergen, 1 VII 1934, *Nannenga 364* (Nga).

Noord-Brabant: Rozendaal, *Buse & Buse-Koppiers* (L).

f. **coralloidea** (Wallr.) Körb., Syst. Lich. German., 1855, p. 46; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 297 et vol. 10, 1940, p. 545 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 261 — *Parmelia glauca* m. *coralloidea* Wallr., Fl. Cryptog. German., vol. 1, 1831, p. 522.

Margins of the lobes lacerate, developing into long, slender, richly and dendritically branched isidia or laciniae which, in their turn, may be more or less isidiate or sorediate.

Noord-Holland: Terschelling, concessie De Gavere, 9 VIII 1939, *Westhoff* (L).

2. **Cetraria chlorophylla** (Willd.) Vain. in Act. Soc. F. Fl. Fenn., vol. 13, 1896, p. 7; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 262; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 543 — *Lichen chlorophyllus* Willd. in Humb., Fl. Friburg. Specim., 1793, p. 20 (non vidi) — *Cetraria saepincola* var. *chlorophylla* Schaer., Lich. Helvet. Spicil., sect. 5, 1833, p. 252; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 121.

Sub nomine: *Cetraria scutata* (Wulf.) Pötsch; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 317 (ubi lit. et synon.).

Sub nomine: *Cetraria sepincola* Ehrh.; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 12.

Macroscopical description. Thallus foliaceous, growing in loose rosettes, fixed to the substratum by means of a few rhizinae, deeply incised. Lobes thin, somewhat cartilaginous, elongate, up to 2 cm long, 1—4 mm broad, discrete or overlapping, undulate, more or less canaliculate, irregularly incised and branched. Margins more or less undulate or crispate, ascendent, partly entire or irregularly crenate, partly sorediate or isidiate. Tips broadened, deeply incised, lobate or crenate. Upper surface of the lobes pale green-brown to dark brown, more or less shiny, smooth or irregularly reticulately dented, sorediate or isidiate and sorediate. Soralia and isidia marginal, sometimes laminal. Lower side of the lobes white to dingy white in the centre, turning pale brown towards the tips of the lobes, more or less shiny, reticulately dented or veined, in the centre with scattered, usually solitary rhizinae which are white or pale brown, simple or somewhat furcate. *Microscopical description.* Upper cortex colourless with a brown outer zone, paraplectenchymatous, 18—25 μ. Gonidia bright green, spherical or ellipsoidal, 6—14 μ, arranged in clusters of 15—30 μ, closely under the upper cortex. Medulla colourless, white in reflected light, more or less thinly plectenchymatous, consisting of meso-pachydermatous hyphae, 20—70 μ. Lower cortex colourless or with a narrow brownish outer zone, scleroplectenchymatous at the very tips of the lobes, but gradually turning more paraplectenchymatous towards the centre of the thallus, 15—20 μ. *Apothecia* and *pycnidia* not observed.

Chemical reactions. Upper cortex as well as medulla unaltered by the usual reagents.

Distribution. In several states of the Balkan peninsula, such as Bulgaria, Greece, Rumania, and Yugoslavia, the species seems to be missing. From Spain, too, no record is known, though this may be due to some oversight. Much more unlikely is its absence in Belgium; surely the species has been overlooked there.

Key to the varieties.

1a. Thallus sorediate or, if additionally isidiate, isidia sometimes becoming sorediose var. **ulophylla** (Ach.) Maas G.
1b. Thallus esorediate or almost so, isidiate instead var. **klementii** (Serv.) H. Magn.

var. **ulophylla** (Ach.) Maas G. nov. comb. — *Cetraria saepincola* var. *ulophylla* Ach., Meth. Lich., 1803, p. 297.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 26, fig. 1; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, fig. 18; Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 2, fig. 1; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 23, fig. 3, 6.

Marginal soralia at first dark brown, later on whitish by abrasion, more or less confluent and frequently completely bordering the lobes. Laminal soralia rare, punctiform, mainly located at the tips of the lobes. Isidia marginal, located at the tips of the lobes, sometimes also laminal, usually darker than the upper side of the thallus, solitary or clustered, short and wart-like or somewhat coralloid, sometimes bursting and becoming albo-sorediose.

Ecology and frequency. On deciduous trees, particularly on beech and birch, and on boulders, frequently occurring together with *C. glauca*, but perhaps somewhat less hygrophilous than that species.

Remarks. I consider this variety to correspond with the type of *Lichen chlorophyllus*.

Groningen: Haren, Harendermolen, 1845, *Van Hall* (NBV).

Drente: Bronneger, 6 V 1941, *Maas G. 975, 977* (L); Drouwen, 2 VIII 1837, *Van Hall* (NBV); Hoogeveen, Kremboong, 9 VI 1933, *Van Ooststroom 5599b* (L); Midlaren, 23 VIII 1855, *Van Hall* (NBV); 1858, *Acker Stratingh* (Gro, NBV); 21 VII 1860, *Van Hall* (NBV); Noordsleen, 15 VII 1939, *Van Ooststroom & Zaneveld* (L); Noordsleen-Emmen, 13 XII 1940, *Maas G. 263* (L); Rolde, V 1849, *Van den Bosch* (L, NBV); Valthe, 7 V 1941, *Maas G. 1065* (L); Weerdinge, 2 VIII 1837, *Van Hall* (L, NBV).

Overijsel: Denekamp, Singraven, 8 VIII 1879, *Van der Sande Lacoste* (L, NBV).

Gelderland: Apeldoorn, 1875, *Kok Ankersmit* (L); Apeldoorn, 't Loo, 1 VIII 1854, *Van der Sande Laooste* (L, NBV); 19 VIII 1869, *Van der Sande Lacoste* (NBV); Bennekom, Hullenberg, 6 IX 1942, *Maas G. 2212* (L); Doornspijk, 28 X 1941, *Groot & Van Soest 629* (VS); 26 IV 1942, *Maas G. 1871* (L); Doornspijk, Nieuw Soerel, IV 1942, *Maas G. & Van Soest 766* (VS); 25 IV 1942, *Maas G. 1854* (L); Drempt-Hoog Keppel, Ulenpas, 13 VI 1943, *Maas G. 2564* (L); Ede, Edesche bosch, *Buse & Buse-Koppiers* (L); Ellekom, Hagenau, 8 VIII 1942, *Van Rossem 270* (L); 13 VI 1943, *Maas G. 2539, 2546* (L); Garderen, 4 I 1941, *Nannenga 1* (Nga); Hoenderloo, III 1946, Mrs. *Maas Geesteranus-Lusink* (L); Hoenderloo-Beekbergen, Spelderholt, 28 III 1943, *Maas G. 2374* (L); Hoenderloo-Uchelen, 27 III 1943, *Maas G. 2364* (L); Nieuw Reemst, *Buse & Buse-Koppiers* (L); Rheden, Beekhuizen, *Buse & Buse-Koppiers* (L); Speulde, 28 V 1939, *Nannenga 813* (Nga); Uddel, Uddelermeer, 1849, unio NBV (L, NBV); Voorst, 27 XII 1919, *Hart de Ruyter* (U); Wolfheze, *Buse & Buse-Koppiers* (L, NBV); 25 X 1941, *Nannenga 1223* (Nga).

Utrecht: De Bilt, 3 III 1928, *Wassink 3360* (Wask); 16 I 1930, *Wassink 3351, 3359* (Wask); 8 III 1930, *Wassink 233* (Wask); Leersum, Darthuizen, 30 VI 1849, *Van Hall* (NBV); Maarn, 6 V 1922, *Ten Kate* (L); Maarsbergen, 1 VII 1934, *Nannenga 365* (Nga); De Vuursche, Lage Vuursche, 7 V 1939, *Nannenga 778* (Nga); 9 IV 1944, *Agsteribbe* (L); Zeist, 20 V 1934, *Nannenga 343* (Nga); 13 X 1934, *Nannenga 516* (Nga).

Noord-Brabant: Boxtel-Best, Veldersbosch, 14 XI 1943, *Barkman 669* (L); Oisterwijk, 18 XI 1943, *Barkman 681* (L); Oisterwijk, Gemullehoeken, 18 XI 1943, *Barkman 692* (L); Oisterwijk, Groot Speyck, 12 IX 1934, *Nannenga 508* (Nga); Oisterwijk, Logtsche heide, 23 VII 1943, *Maas G. 2612* (L); Rozendaal, *Buse & Buse-Koppiers* (L); Tongelre, I 1925, *Smelt* (VD Wijk); Vught, 2 V 1903, *Wakker* (L).

var. **klementii** (Serv.) H. Magn. in Bot. Notis., 1934, p. 478; Hillm. in Rabenh. Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 264; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 543 — *Cetraria scutata* var. *klementii* Serv. apud Serv. et Klem. in Vestnik Král. Cesk. Spol. Nauk., vol. 2, 1932, sep. p. 32 (non vidi).

Thallus esorediate or almost so, but with isidia instead. Isidia usually marginal, frequently also laminal, dark fuscous, wart-like or coralloid, or developing into folioles.

Remarks. As Dr Magnusson kindly informed me, the specimens of Servít's show a few small folioles. In the Dutch material, however, things are somewhat different as we may find folioles grown out to proportionally a considerable length of up to 1 or 2 mm. They are entire or crenate, and they may in their turn have isidiate margins.

Overijsel: Lemele-Dalfsen, 27 VII 1941, *Maas G. 1351b* (L).

Gelderland: Doornspijk, de Haere, 25 IV 1942, *Maas G. & Van Soest 779* (VS); Doornspijk, Nieuw Soerel, 25 IV 1942, *Maas G. 1859* (L); Doornspijk, Soerel, IV 1942, *Maas G. & Van Soest 765* (VS); Garderen, 4 I 1941, *Stafleu* (Nga); Garderen-Boeschoten, 4 I 1941, *Stafleu* (U); Hierden, Hulshorst, 24 X 1941, *Maas G. 1558* (L); 25 X 1941, *Maas G. 1588, 1589* (L).

Utrecht: Driebergen, 24 III 1946, *Bakhuizen van den Brink* (L); Maarsbergen, 13 VI 1936, *Nannenga 613* (Nga); 9 IV 1944, *Agsteribbe* (L).

Noord-Brabant: Oisterwijk, Gemullehoeken, 18 XI 1943, *Barkman 666* (L).

Subsectio 2. Flavescentes Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 267; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 543.

Upper side of the thallus greenish yellow, pale yellow or strongly lemon-yellow. Medulla white or yellow.

3. Cetraria pinastri (Scop.) S. Gray, Natur. Arrang. Brit. Pl., vol. 1, 1821, p. 432 (non vidi); Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 12; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 309 et vol. 10, 1940, p. 548 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 272 — *Lichen pinastri* Scop., Fl. Carniol., ed. 2, vol. 2, 1772, p. 382 (non vidi).

Macroscopical description. Thallus foliaceous, growing in rosettes or irregularly wide-spreading, fixed to the substratum by means of a few rhizinae, more or less deeply incised. Lobes soft, up to 1 cm long, 1—5 mm broad, overlapping, rarely flat, usually more or less undulate or canaliculate, irregularly incised or branched. Margins ascending, wavy or crispate, partly entire or crenate, partly sorediate. Tips somewhat broadened, emarginate, crenate, incised or sorediate. Upper surface of the lobes yellow-green or grey-green, dull or slightly shiny, smooth or faintly and irregularly dented or wrinkled, with a few cortical cracks, without isidia, sorediate. Soralia marginal, rarely also laminal, in one case almost completely covering the lobes. Lower side of the lobes pale yellow or brownish yellow, dull, veined, near the centre of the thallus with some scattered dingy white rhizinae. *Microscopical description.* Upper cortex brownish, indistinctly paraplectenchymatous, 15—30 μ. Gonidia bright green, spherical, 10—15 μ, arranged in clusters of 30—50 μ closely under the upper cortex. Medulla yellowish, chrome in reflected light, 20—120 μ, consisting of mesodermatous hyphae. Lower cortex colourless, paraplectenchymatous, 15—30 μ. *Apothecia* and *pycnidia* not observed.

Chemical constituents and reactions. Upper cortex as well as medulla indifferent to the usual reagents. According to Zopf (Flechtenstoffe, 1907, p. 75, 77, 95, 99, 104, 420) the following lichen acids are known to occur in this species: vulpic acid ($C_{19}H_{14}O_5$) (Hesse), pinastric acid ($C_{20}H_{16}O_6$) in the medulla and in the soralia, usnic acid ($C_{18}H_{16}O_7$) in the upper cortex. Asano and Kameda confirmed the formula of pinastric acid to be $C_{20}H_{16}O_6$ (in Ber. Deutsch. Chem. Ges., vol. 67B, 1934, p. 1522—1526).

Distribution. According to the literature records, this species occurs throughout Europe.

Remarks. Owing to its conspicuously yellow medulla in addition to its equally highly coloured sorediose fringe, there is no possibility of confusing *C. pinastri* with any other lichen species now occurring in Holland, not even with any of the *Xanthoriae* from which it, moreover, differs, in that the cortex is insensitive to K.

var. **pinastri** (Ach.) Maas G. nov. comb. — *Cetraria juniperina* var. *pinastri* Ach., Meth. Lich., 1803, p. 298.

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928, tab. 26, fig. 2; Bitter in Jahrb. wiss. Bot., vol. 36, 1901, tab. 10, fig. 39—41; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 15; Fink in Contrib. Unit. States Nation. Herb., vol. 14, pars 1, 1910, tab. 36, fig. B; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 25, fig. 4.

Soralia marginal only (soralia limbiformia), solitary or more or less completely bordering the margins of the lobes with a strongly yellow fringe.

Ecology and frequency. On wood (old fences, palings, etc.), on deciduous and coniferous trees, extremely rare.

Remarks. I consider this variety to agree with the type of *Lichen pinastri.*

Drente: Eext, 3 V 1941, *Maas G. 752* (L).
Gelderland: Renkum, 1850, *Buse & Buse-Koppiers* (L).
Utrecht: Grebbe, 1862, *Buse & Buse-Koppiers* (L, NBV).
Noord-Brabant: Vugt, Loverensche brug, 15 X 1904, *Wakker* (L).

Sectio 2. EUCETRARIA Körb.,

Parerg. Lichenol., 1865, p. 17; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 320 et vol. 10, 1940, p. 543 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 284.

Thallus fruticose, more or less upright, cartilaginous and stiff. Lobes canaliculate or even tubular. Usually terricolous.

Subsectio 1. Obscuriores Hillm.

in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 291; A. Zahlbr., Cat. Lich. Univ., vol. 10, 1940, p. 543.

Upper side of the lobes brownish or green-brown. Colour of the lower side usually different from that of the upper one.

4. **Cetraria islandica** (L.) Ach., Meth. Lich., 1803, p. 293; Van den Bosch in Prodr. Fl. Batav., vol. 2, pars 2, 1853, p. 121; Abelev. in Prodr. Fl. Batav., ed. 2, vol. 2, pars 2, 1898, p. 12; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 325; vol. 8, 1932, p. 570 et vol. 10, 1940, p. 545 (ubi lit. et synon.); Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 291 — *Lichen islandicus* L., Spec. Pl., vol. 2, 1753, p. 1145.

Macroscopical description. Thallus fruticose, sometimes forming dense tufts, decumbent, ascending or erect, without rhizinae, but loosely adhering to the ground and kept upright by surrounding plants, dying at the base, deeply incised. Lobes cartilaginous and stiff, most variable in form and size, elongate and slender or broad and leaf-like, from 1—10 cm long, though never exceeding 3—5 cm in Holland, 3—30 mm broad, almost flat to distinctly canaliculate or even tubular, repeatedly dichotomously or irregularly branched. Margins bent inward, frequently additionally revolute, entire, either shortly ciliate or not (cilia may also protrude from the pseudocyphellae and from the lower surface). Tips usually broadened, flattened, sometimes broadly rounded, usually emarginate or dichotomously incised. Upper side of the lobes varying from pale greenish white, green-brown, pale brown to almost black-brown, frequently turning paler towards the base, somewhat reddening or bright blood-red at the base, more or less shiny, smooth, uneven or dented, without cortical cracks or isidia, in a single case sorediate. Lower side lighter-coloured than the upper side, pale grey-brown to white, also reddening at the base, sometimes darker towards the tip, more or less shiny, lengthways grooved or dented, dotted with pseudocyphellae. Pseudocyphellae white, impressed or somewhat convex, laminal and submarginal; the former roundish or irregularly shaped, the latter long-drawn and linear. *Microscopical description.* Upper cortex colourless except for a narrow brown exterior zone, composed of an inner scleroplectenchymatous zone of 15—45 μ, and an outer, paraplectenchymatous zone of 10—28 μ. Gonidia bright green, spherical, 7—15 μ, arranged in clusters of about 30 μ, closely under the upper cortex or scattered throughout the medulla. Medulla colourless, white in reflected light, more or less densely plectenchymatous, consisting of pachydermatous hyphae, 40—100 μ. Lower cortex similar to the upper cortex. *Apothecia* and *pycnidia* not observed. Pycnidia are known to be located in the apices of the short marginal spines, but I have not yet been able to detect any in the indigenous material.

Chemical constituents and reactions. Lower cortex (rather more conspicuously than the upper one) as well as medulla J + violet-blue. Medulla as well as pseudocyphellae Pd + orange-red.

According to Zopf (Flechtenstoffe, 1907, p. 15, 49, 173, 421), the species contains protolichesteric acid ($C_{19}H_{32}O_4$) and fumarprotocetraric acid ($C_{62}H_{50}O_{35}$). The presence of the latter compound in the European *Cetraria islandica* is affirmed by Asahina and Yanagita (in Ber. Deutsch. Chem. Ges., vol. 69 B, 1936, p. 120—125). Asahina and Tanase (ibidem, vol. 67 B, 1934, p. 411—416) find its formula $C_{22}H_{16}O_2$ to fit better the modern state of analysis. From investigations by Asahina and Yasue (ibidem, vol. 70 B, 1937, p. 1053—1059), it appears that, at least in Japanese material, next to protolichesteric acid there may also be found lichesteric acid. Fumarprotocetraric acid evokes the orange colour in the medulla when treated with Pd. The violet colouration of the lower side on application of J is due to the starchy compounds lichenin and isolichenin ($C_6H_{10}O_5$).

Distribution. As may be concluded from the records in literature, *Cetraria islandica* is widely distributed all over Europe.

Remarks. Though the Dutch specimens show some variability as to size and colour, I generally refrain from assigning them to any of the forms known for lack of material for comparison.

Some words may be said concerning the peculiar distribution of this species in Holland. As is shown in the map (fig. 18), no localities are known within a broad strip along the coast of the North Sea. In the Frisian Islands the species is lacking as well, and corresponding therewith it is interesting to learn that Sandstede (in Abh. naturw. Ver. Bremen, vol. 12, 1892, p. 173—204) has never found *C. islandica* in any of the East Frisian Islands (Wangerooge, Spiekerooge, Langeooge, Baltrum, Norderney, Juist and Borkum). From the papers by Giltay (in Bull. Soc. Roy. Bot. Belg., vol. 61, 1928, p. 120—122) and Duvigneaud & Giltay (ibidem, vol. 70, 1938, Suppl.) it likewise appears that *C. islandica* is missing from the Belgian coastal region, the most westerly locality being Mons. Proceeding further south, the species again appears to avoid the proximity of the ocean in France: "manque dans tout l'ouest, le nord-ouest, ..." (Olivier in Mém. Soc. Nation. Sci. Natur. Mathém. Cherbourg, vol. 36, 1906/07, p. 166). On the other hand, all these instances, however in favour of the view of the species occurring in places away from the sea, may easily be opposed by several others which prove the reverse. To begin with, Tavares (in Portugal. Act. Biol., vol. 1 B, 1945, p. 180) found *C. islandica* in the environs of Mafra, northwest of Lisbon, which, though being at some elevation above the sea, is quite near the shore. Farther north, in Germany, Denmark and Scandinavia, evidences of *C. islandica* growing near the sea become much more frequent. For Germany records are stated e. g. by Von Fischer-Benzon (Die Flechten Schleswig-Holsteins, 1901, p. 73): Süderholz and Horstedt near Husum, Lügumkloster, St. Laurentius in the Island of Föhr; by Sandstede (in Abh. naturw. Ver. Bremen, vol. 13, 1894, p. 122): Island of Föhr; and by Erichsen (in Ann. Mycol., vol. 39, 1941, p. 26): near Lügumgaard, Kreis Tondern. For Denmark some records are enumerated e. g. by Gelting (in Bot. Tidsskr., vol. 45, 1941, p. 405): Strøby Luftfyr and Solrød. For Norway localities are given e. g. by Havås (in Bergens Mus. Årb., (1935) 1936, no. 2, p. 16): Stadtland; by Degelius (ibidem, (1934) 1935, no. 3, p. 26): Nordfjord and

Sunnfjord; and Degelius (in Nytt Mag. Naturvidensk., vol. 78, 1938, p. 284); Moskenesøy, Lofoten.

From all this it will be clear that there must be factors other than the proximity of the sea determining the distribution of the species.

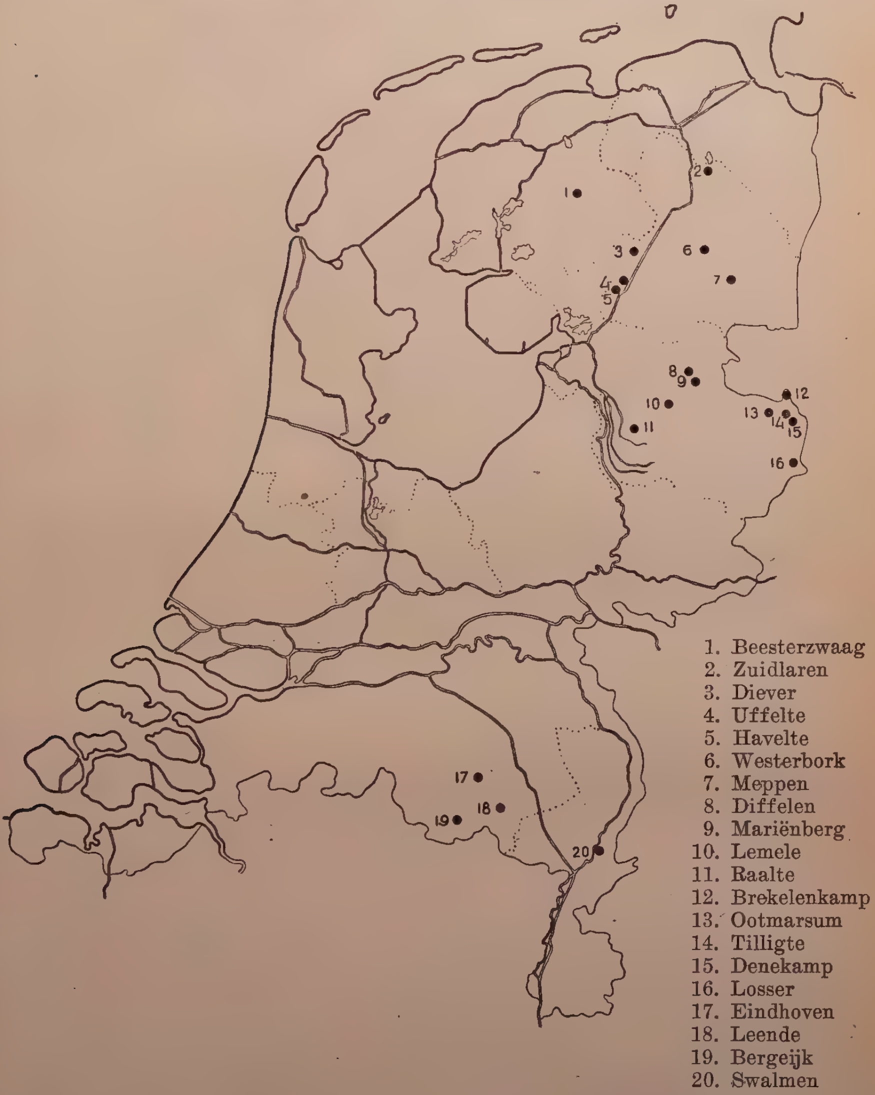

Fig. 18 — Map showing the distribution of *Cetraria islandica* (L.) Ach. in Holland.

Tavares (in Portugal. Act. Biol., vol. 1B, 1945, p. 180), discussing the ecology of the species, stresses the importance of such climatic factors as humidity, exposition and, to a lesser degree, temperature: "Particularly the influence of the humidity is demonstrated, since the species, growing in an atmosphere of already raised humidity (fogs and precipitation), occurs in company of tufts of mosses which to a greater extent retain the water". Apparently, this inclination towards a moist habitat is much less pronounced in Holland. At any rate it does not suffice to explain the lack of the species in heaths in the middle of the country which ostensibly seem equally suited to the establishing of *C. islandica* as those farther east.

var. **vulgaris** Schaer., Lich. Helvet. Spicil., sect. 1, 1823, p. 11 et sect. 5, 1833, p. 253.

Thallus ascending or erect. Lobes up to 1 cm broad, with emarginate or dichotomously incised tips, esorediate. Cilia lacking or marginal only.

Key to the forms.

1a. Upper side pale to dark brown or greenish brown, lower side paler, but, except at the base, never white 2
    2a. Lobes up to 3 or 5 cm long, up to 1 cm broad var. **vulgaris** Schaer. f. **eu-vulgaris** Maas G.
    2b. Lobes smaller and narrower . . . var. **vulgaris** Schaer. f. **minor** Grogn.
1b. Upper side pale greenish, lower side white var. **vulgaris** Schaer. f. **pallida** Britzelm.

var. **vulgaris** f. **eu-vulgaris** Maas G. nov. f.

Typus: the same as of *Lichen islandicus.*

Iconography: Anders, Strauch- u. Laubfl. Mitteleurop., 1928. tab. 25, fig. 2; Cretzoiu in Inst. Cercetar. Experim. Forest., ser. 2, no 47, 1941, tab. 9, fig. 1; Dietrich, Deutschl. Kryptog. Gew., vol. 4, 1846, tab. 12; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, fig. 24; Howe in Bryologist, vol. 16, 1913, tab. 3, fig. 2 (type specimen); Magnuss., Fl. Skand. Busk- och Bladlav., 1929, tab. 2, fig. 3; Migula, Kryptog.-Fl. Deutschl., vol. 4, pars 1, 1929, tab. 24, fig. 1; Schaer., Enum. Crit. Lich. Europ., 1850, tab. 2, fig. 2; Smith et Sowerb., Engl. Bot., vol. 19, 1804, tab. 1330; Wulf. in Jacquin, Collect. Bot., vol. 4, 1790, tab. 8, fig. 1; A. Zahlbr. in Engler-Prantl, Die natürl. Pflanzenfam., ed. 2, vol. 8, 1926, tab. 115, fig. B.

Lobi usque ad 10 cm longi et 1 cm lati, plus minusve canaliculati, marginibus plus minusve ciliatis, supra fusci vel olivacei, subtus pallidiores nonnumquam versus basin sordide albescentes.

Lobes up to 10 cm long (less in Holland!), up to 1 cm broad, more or less canaliculate. Margins more or less ciliate. Upper side pale to dark brown or greenish brown. Lower side paler than the upper side, sometimes dingy white towards the base.

Ecology and frequency. In open heaths, on bare ground or among *Cladoniae* (*Cladina*-group) and low *Calluna* or *Erica.* Wanting in the western part of Holland, somewhat rare in the eastern part.

Remarks. From the scanty material represented in the older herbaria it might be concluded that *Cetraria islandica* has always been very rare in Holland. One would hardly assume that this conspicuous species could have escaped the attention of the earlier collectors. Yet, I think this must have been the case. In the localities examined, the plants are thriving well, and I am convinced that the species would be much more common, but for the waste lands now brought into cultivation. I have no reason to think of this species being recently introduced.

Friesland: Beetsterzwaag (Gro).

Drente: Diever-Wittelte, 2 VIII 1941, *Maas G. 1502* (L); Havelte, 2 VII 1939, *Nannenga 949, 950* (Nga); VIII 1940, *Stafleu* (U); Meppen, 3 VIII 1944, *Caron* (L); Westerbork, 1944, *Wasscher* (L, Wasr); Zuidlaren, XI 1856, *Acker Stratingh* (Gro); VII 1858, *Acker Stratingh* (NBV); X 1858, *Acker Stratingh* (Gro, L, NBV).

Overijsel: Denekamp, 22 VII 1932, *Wassink 1894* (L, Wask); Denekamp, Brekelenkamp, 21 VII 1941, *Besemer* (L); Diffelen, Diffeler zand, 3 VIII 1939, *Van Ooststroom 7444* (L); Lemele, Lemeler berg, 29 VII 1941, *Maas G. 1389* (L); Losser, Beuningerbinnenveld, 19 VI 1944, *Westhoff* (L); Mariënberg, 28 VII 1941, *Maas G. 1371* (L); Ootmarsum, Ottershagen, 13 VI 1944, *Westhoff* (L); Raalte, 't Evenbelt, VII 1916, *Lako* (L, NBV); Raalte, de Posthoorn, V 1910, *Lako* (L, NBV).

Noord-Brabant: Bergeyk, Weebosch, 26 VII 1942, *Maas G. 2118* (L); Eindhoven, Stratumsche heide, 12 X 1946, Miss *Preus* (L); Leende, II 1929, *Smelt* (VD Wijk).

Limburg: Swalmen, VIII 1942, *Sissingh* (L).

var. **vulgaris** f. **pallida** Britzelm. in Beih. Bot. Centralbl., vol. 22, pars 2, 1907, p. 333; A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 331 et vol. 10, 1940, p. 546; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 295.

Upper side of the thallus pale greenish, lower side white or whitish. Margins eciliate or with a few cilia.

Ecology. Growing in shady places.

Remarks. As Hillmann already stated (l. c. p. 296), it seems very doubtful if there is any difference between f. *pallida* Britzelm., f. *virescens* Anders (in Hedwigia, vol. 65, 1924, p. 83) and f. *pallescens* Erichs. (in Verh. Bot. Ver. Prov. Brandenburg, vol. 72, 1930, p. 21). As long as nothing more positive can be said, I prefer the use of the epithet *pallida*, considering the two others to be synonymous.

The sole Dutch find presumably does not in every respect represent genuine f. *pallida*, since the upper side is very pale olive instead of greenish white. The lower side, however, is white, and the margins are almost destitute of cilia.

Overijsel: Denekamp, Voltherbeek, 7 VIII 1945, *Van Dijk Jr* (L).

var. **vulgaris** f. **minor** Grogn., Pl. Chyptog.-Cellul., 1863, p. 55 (non vidi); A. Zahlbr., Cat. Lich. Univ., vol. 6, 1929, p. 331 et vol. 10, 1940, p. 546; Hillm. in Rabenh., Kryptog.-Fl. Deutschl., ed. 2, vol. 9, pars 5/3, 1936, p. 296.

Thallus small, with small and narrow lobes.

Drente: Havelte, Brantingerbosch, 7 VII 1939, *Nannenga 906* (Nga); Uffelte, VIII 1919, *Ten Kate* (L).

Overijsel: Tilligte, 17 VI 1930, *Van Ooststroom 3438a* (L).

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UNSERE GEGENWAERTIGE KENNTNIS UEBER DIE LILIACEENGATTUNG DIANELLA IN MALESIEN

von

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I. VORWORT.

Im Zusammenhang mit dem Assistentenaustausch, während dem ich meinen Arbeitsplatz im Sommer 1947 für 5 Monate aus dem Botanischen Garten und Museum der Universität Zürich nach dem Rijksherbarium in Leiden verlegte, war es mir möglich, die Gattung *Dianella* erneut zu studieren. Insbesondere bot sich Gelegenheit die Untergattung *Rhuacophila,* mit der einzigen Art *D. javanica* und die beiden Subsektionen *Odorata* und *Sparsiflora* näher kennen zu lernen.

Bearbeitet wurde das gesamte *Dianella*material des Rijksherbariums Leiden und dasjenige des Herbariums Utrecht; ferner zwei Pflanzensendungen aus den Herbarien der Harvard University, Cambridge (Mass.), die eine davon aus dem Herbar des Arnold Arboretums, die andere aus dem Gray Herbarium. Den Vorstehern aller genannten Herbarien sei an dieser Stelle für die bereitwillige Ueberlassung des Materials aufrichtig gedankt.

Viele Belegstücke dieser Herbarien stellten wertvolle Ergänzungen zu solchen dar, die mir aus den Herbarien der Museen von Berlin, Kew, Paris, und Zürich schon bekannt waren. Das Material dieser letztern Herbarien, von denen das berlinsche durch den Krieg zerstört worden ist, lieferte damals die Grundlage für die "*Monographie der Liliaceengattung Dianella Lam.*" (Mitt. aus dem Bot. Mus. d. Univ. Zürich CLXIII, Ende Okt. 1940, S. 1—283, 35 Taf.).

Die hier veröffentlichten Ergebnisse tragen den Charakter einer Uebergangslösung, welche dem Stand unserer gegenwärtigen Kenntnis über die malesischen Dianellen angepasst ist.

Bevor ich zum eigentlichen Thema übergehe, möchte ich allen denen, die an dieser Arbeit durch Ueberbringen von Material, durch Anfertigung der Zeichnungen, durch Literaturbeschaffung, durch nomenklatorische Hinweise und durch Entzifferung von Herbaretiketten mitgewirkt haben, meinen verbindlichsten Dank aussprechen. Besonderen Dank verdienen die Herren Vorstände der verschiedenen Institute, die mir in freundlichster Weise das gewünschte Material zur Verfügung stellten.

Bei der Erwähnung der Belegexemplare sind womöglich die Namen der Sammler und die Nummern angegeben. Ein ! bedeutet: Exemplar selbst eingesehen. Durch Buchstaben ist folgenderweise angegeben worden, wo das betreffende Exemplar liegt:

A — Arnold Arboretum, Jamaica Plain (Mass.), Ver. St. von Amerika.
B — Botanisches Museum, Berlin-Dahlem (Herb. zerstört).
GH — Gray Herbarium, Harvard University, Cambridge (Mass.), Ver. St. von Amerika.
K — Royal Botanic Gardens, Kew (Surrey), England.
L — Rijksherbarium, Leiden.
U — Herbarium der Reichsuniversität Utrecht.
Z — Herbarium der Universität Zürich.

II. HAUPTERGEBNISSE.

Von den Arten der beiden Subsektionen *Odorata* und *Sparsiflora* wissen wir schon aus der Monographie, dass sie sich nicht scharf voneinander abgrenzen lassen. Damals wagte ich das nur vage auszusprechen, aus Zweifel, nicht genügend Material gesehen zu haben und aus Rücksicht auf die vielen von ältern Autoren beschriebenen Arten, die ich dort nicht weiter als auf einen Drittel zu reduzieren wagte.

Die erneuten Untersuchungen haben das Ineinanderfliessen aller Arten dieser beiden Subsektionen so vollkommen bestätigt, dass ich mehr denn je von der Richtigkeit des in der Monographie eingeschlagenen Weges und der dort angedeuteten Auffassung überzeugt bin.

Eingehende morphologisch-anatomische Untersuchungen haben den Beweis geliefert, dass ausser *D. javanica* keine einzige der bisher beschriebenen malesischen Dianellen sich von den übrigen scharf begrenzen lässt; d.h. also auch die beiden Subsektionen *Odorata* und *Sparsiflora* gleiten ganz allmählich ineinander über, wenn auch die einzelnen Pflanzenindividuen oft sehr verschieden aussehen. Einzig *D. javanica* ist von den übrigen durch einen Hiatus getrennt.

Diese Feststellung gibt Anlass zu einer neuen, in der Monographie nur partiell verwirklichten Auffassung der malesischen Dianellen, nämlich: In ganz Malesien existieren nur zwei linnéische Arten, das sind *D. javanica* (Bl.) Kth. und *D. nemorosa* Lam. em. Schl.

Der eine Linnéont, *D. javanica,* ist in sich erstarrt und zeigt in seinem ganzen Areal nur geringfügige Variationen.

Der andere Linnéont, *D. nemorosa,* ist in einer Evolutionsphase und bildet von Standort zu Standort neue Formen. Die extrem entwickelten Glieder der örtlichen Formenschwärme täuschen auf den ersten Blick tatsächlich eine "Art" vor; sie gleiten aber durch unzählige Intermediäre in die Formen anderer Lokalitäten über. Dieser labile Linnéont baut mit denselben Elementen von Ort zu Ort neue Phänotypen, neue ökologisch angepasste Formen auf. Er hüllt sich in den verschiedenen Teilen seines Riesenareals immer wieder in ein anderes Kleid.

Er ändert seine Merkmalskombination von Westen nach Osten ganz allmählich so, dass er seinen uns aus Ostasien und den grossen Sunda-Inseln bekannten indischen Habitus (f. *montana,* f. *robusta*) auf den Philippinen (f. *gracilis*), Molukken (f. *odorata*) und auf Neuguinea in eine intermediäre Tracht umwandelt, die im südöstlichen Neuguinea, im Fly-River-Gebiet bei einzelnen Formenschwärmen (f. *congesta*) schon ganz australes Gepräge annimmt. Dazu sei noch bemerkt, dass die Exemplare eng begrenzter Lokalitäten, wie in gewissen Stromgebieten, auf kleinen Inseln (Bangka), an Einzelbergen (Mt. Kinabalu) wieder ihren ganz lokalen Charakter zeigen.

Dem Ergebnis, dass wir auf morphologisch-anatomischem Wege nur zwei — wirklich durch einen Hiatus getrennte — linnéische Arten unterscheiden können, steht die merkwürdige Tatsache gegenüber, dass die Belegexemplare, die von einer Lokalität stammen, weitgehend denselben Charakter tragen. Ausserdem habe ich an den wenigen in Zürich kultivierten (allerdings australischen) Pflanzen die Beobachtung machen können, dass sie in ihrem Phänotypus sehr stabil bleiben. Dazu ist zwar zu bemerken, dass bis jetzt in den Kulturen auch nie versucht wurde, die edaphischen und klimatischen Bedingungen zu ändern.

Ich bin aber der Ansicht, dass wir diesen Erscheinungen Rechnung tragen müssen. Wir haben somit bei diesem labilen Linnéonten einerseits eine erwiesene Inkonstanz aller morphologisch-anatomischen Merkmale und anderseits werden an bestimmten Lokalitäten doch scheinbar sehr konstante Formenschwärme differenziert.

Damit ergeben sich die wichtigen Fragen: Wie reimt sich die lokale phänotypische Konstanz mit der über das Grossareal festgestellten Verschiebung aller Merkmalskombinationen und aller Einzelmerkmale zusammen? Welches sind die Ursachen, die an bestimmten Orten diesen labilen Linnéonten dazu bewegen, etwas zu entwickeln, was auf den ersten Blick einer guten Art gleicht?

Diese für das Gesamtbild der Gattung *Dianella* sehr entscheidenden Probleme, lassen sich nur durch ausgedehnte experimentelle Untersuchungen an lebendem Material und durch eingehende Beobachtungen an lebenden Pflanzen in Kultur und an ihren natürlichen Standorten, also in der Heimat der Dianellen lösen.

Das Studium von Herbarmaterial erweist sich bei *Dianella* wohl als sehr nützlich und bildet die Grundlage für alles weitere, aber es reicht niemals aus, um die komplizierten Verhältnisse der Gattung zu erklären.

Eine befriedigende Lösung können nur die oben postulierten Experimente und Beobachtungen an lebenden Pflanzen in Kultur und an ihren natürlichen Standorten geben, was schon Bentham aussprach und was auch aus dem Schlusswort der Einleitung zur *Dianella*-Monographie hervorgeht (Monogr. p. 18).

Einzig auf experimentellem Wege können wir bis zu einem gewissen Grade erfahren, was wir uns unter diesen lokalen Bildungszentren, in welchen an den Individuen einige Merkmale in den Vordergrund rücken, während andere verschwinden, vorzustellen haben. Ob wir solche Bildungszentren, wenn sie sich genügend scharf herausheben, schon als Arten auffassen dürfen, wie das bis jetzt von allen Autoren, die sich mit *Dianella* beschäftigten, gemacht worden ist, oder ob im malesischen Areal nur zwei Linnéonten vorliegen, ein stabiler in *D. javanica* und ein labiler in *D. nemorosa*.

Aus diesen Gründen stellen die Ergebnisse dieser Arbeit nur eine vorübergehende Lösung mit neuen Gesichtspunkten dar. In der nachfolgenden Uebersicht über die Gattung *Dianella* ist die neue Auffassung der malesischen Dianellen als Glieder zweier Linnéonten vergleichsweise neben die Darstellung in der Monographie mit “fliessenden Arten” gesetzt. Es geschah dies einerseits um die Beziehungen mit der Monographie aufrecht zu erhalten, denn diese bildet auf jeden Fall die Grundlage für alle weitern Forschungen, und anderseits hat dann der Interessent selbst die Wahl, welcher Auffassung er sich zuwenden will.

Um möglichst wenig nomenklatorische Komplikationen hervorzurufen, ehe wir über *Dianella* ein auf experimentellem Wege begründetes klares Bild haben, sind in der neuen Darstellung alle Namen (bisher beschriebener

Arten, Varietäten, und Formen) ohne Unterschied als *formae,* wie das in der Monographie z. T. schon geschehen ist, dem Linnéonten *D. nemorosa* untergeordnet worden. Zweifellos tragen die hier einander gleichgeschalteten Formen verschiedenen Charakter; die einen sind blosse Standortsmodifikationen, die andern sind Mutationen, noch andere sind Bastarde. Einige tragen den Charakter guter geographischer Rassen. Ihre Rangordnung wird also zu ändern sein; in welchem Sinne das aber geschehen muss, darüber können nur genaue Beobachtungen in der Natur und im Experiment entscheiden

Durch die Uebersichtstabelle wird die Beziehung zur Monographie und aller ältern Literatur gewahrt.

Der linnéischen Art *D. nemorosa* ist vor allem aus praktischen Gründen der Vorrang zu geben, denn dadurch wird die längst bekannte Kalamität der Unbestimmbarkeit der Dianellen aus dem Wege geschafft. Der Charakter der Gattung als Gebilde, bestehend aus einem starren und einem labilen Typ, wie das in der Monographie schon beschrieben wurde, wird dadurch nicht verändert. Im Gegenteil wird die enge Zusammengehörigkeit aller dieser artbildenden Herde durch die Unterordnung unter einen Linnéonten noch betont. Es ist in der Tat so, dass diese Grossart an den verschiedensten Stellen, voneinander unabhängige, einander aber sehr ähnliche Parallelen erzeugt, die mindestens z. T. gute geographische Rassen darstellen. Auf Grund der Aehnlichkeit dieser Parallelen werden wir leicht verleitet, sie alle als einander gleichwertig anzusehen. Doch dieser Linnéont zeigt uns, wie ihnen wohl das gleiche Urstammgut zukommt, aber sie sind nicht aus diesem, sondern aus dessen lokal veränderten Kombinationen hervorgegangen und zeigen deshalb genetisch, örtlich und zeitlich verschiedenen Charakter.

III. VERGLEICHEND-SYSTEMATISCHE GLIEDERUNG DER MALESISCHEN DIANELLEN. GEGENUEBERSTELLUNG DER MONOGRAPHISCHEN DARSTELLUNG UND DER NEUEN AUFFASSUNG.

Auffassung in der Monographie: mit z. T. "fliessenden Arten":	Neue Auffassung: mit zwei durch Hiatus getrennten linnéischen Arten:
Subgenus *Rhuacophila* (Bl.) Schl.	Subgenus *Rhuacophila* (Bl.) Schl.
1. *D. javanica* (Bl.) Kth.	1. **D. javanica** (Bl.) Kth.
f. *stenophylla* Schl.	f. *stenophylla* Schl.
f. *alba* Schl.	f. *alba* Schl.
f. *rubra* Schl.	f. *rubra* Schl.

Subgenus *Diana* (Comm. ex Lam.) Schl.	Subgenus *Diana* (Comm. ex Lam.) Schl.

Sektion *Archidiana* Schl. fehlt in Malesien

Sektion *Eudiana* Schl. Subsektion *Odorata* Schl.	fallen in der neuen Gliederung mit dem Subgenus *Diana* zusammen.
2. *D. nemorosa* Lam. (s.str.)	2. **D. nemorosa** Lam. em. Schl. (s. lat.)
f. *gracilis* Schl.	f. *gracilis* Schl.
f. *robusta* (Elm.) Schl.	f. *robusta* (Elm.) Schl.
f. *aspera* Schl.	f. *aspera* Schl.
f. *pallescens* Schl.	f. *pallescens* Schl.
syn. *D. montana* Bl.	f. *montana* (Bl.) Schl.
syn. *D. ensifolia* (L.) Red.	f. *ensifolia* (L. em. Red.) Schl.
syn. *D. bambusifolia* Hall.f.	f. *bambusifolia* (Hall.f.) Schl.
	f. *tenuifolia* Schl. nov. f.
3. *D. odorata* Bl.	f. *odorata* (Bl.) Schl.
f. *racemulifera* Schl.	f. *racemulifera* Schl.

f. *spinulosa* Schl. ist mit f. *aspera* identisch (Uebergänge)

f. *indica* Schl. ist mit f. *odorata* identisch (Uebergänge)

f. *bancana* (Miq.) Schl.	f. *bancana* (Miq.) Schl.
syn. *D. congesta* R. Br.	f. *congesta* (R. Br.) Schl.
	f. *nana* Schl. nov. f.
	f. *latifolia* Schl. nov. f.

Subsektion *Sparsiflora* Schl. fällt in der neuen Gliederung mit dem Subgenus *Diana* zusammen.

4. *D. sparsiflora* Schl. (s. lat.)	f. *sparsiflora* (Schl.) Schl. (s.str.)
var. *flabellata* (Hall.f.) Schl.	f. *flabellata* (Hall.f.) Schl.
var. *carinata* (Hall.f.) Schl.	f. *carinata* (Hall.f.) Schl.
var. *parviflora* (Hall.f. ex Zipp. ms.) Schl.	f. *parviflora* (Hall.f. ex Zipp. ms.) Schl.
var. *albiflora* (Hall.f.) Schl.	f. *albiflora* (Hall.f.) Schl.
var. *ledermanni* (K. Krause) Schl.	f. *ledermanni* (K. Krause) Schl.
var. *monticola* (K. Krause) Schl.	f. *monticola* (K. Krause) Schl.
var. *pullei* (K. Krause) Schl.	f. *pullei* (K. Krause) Schl.
5. *D. monophylla* Hall.f.	f. *monophylla* (Hall.f.) Schl.
6. *D. serrulata* Hall.f.	f. *serrulata* (Hall.f.) Schl.

IV. MORPHOLOGISCH-ANATOMISCHER BESTIMMUNGSSCHLUESSEL DER MALESISCHEN DIANELLEN.

1. Blatthals rinnenförmig, d. h. die beiden Blatthälften sind in der verschmälerten Halspartie nicht miteinander verwachsen. Rispe allmählich aus der Blattregion sich erhebend. Rispenstiel wenig ausgeprägt, mit Laubblättern besetzt. Tragblätter der untern Rispenäste laubartig. Laubblätter am Rand und Rückenkiel völlig wehrlos. Blattscheide mit bis zur Basis freien Rändern. Anatomisch: Epidermiszellen der Blattoberseite papillös, auf der Blattunterseite flach (selten beidseits papillös). Spaltöffnungen auf die Blattoberseite beschränkt . . . . **D. javanica** (Bl.) Kth.

1a. Blatthals massiv, d. h. die beiden Blatthälften in der deutlich verschmälerten Halspartie teilweise oder fast ganz miteinander verwachsen. Rispe durch einen schlanken, aus stark verlängerten Internodien bestehenden Rispenstiel von der Blattregion getrennt. Rispenstiel mit 1—3 voneinander entfernten, kahnförmigkieligen Hochblattschuppen besetzt. Tragblätter der Rispenäste schuppenförmig, schmal, kahnförmig gekielt oder fehlend. Blätter gezähnelt oder wehrlos. Blattscheide an der Basis oft ± ochreaartig geschlossen. Anatomisch: Epidermiszellen der Blattoberseite flach. Spaltöffnungen vorwiegend auf der Blattunterseite und daselbst (wenn entwickelt) auch die Epidermispapillen . . . . **D. nemorosa** Lam. em. Schl.

V. ARTBESCHREIBUNG UND VERBREITUNG.

1. **D. javanica** (Bl.) Kth.

Wichtigste Synonyme: *Rhuacophila javanica* Bl., *Rh. celebica* Bl., *Dianella celebica* Bl., *D. Austro-Caledonica* Seem., vergl. Monogr.

a. Beschreibung:

Niedere Staude bis buschiger, über mannshoher Halbstrauch. Stengel abgeplattet, ca. 5 mm bis über 1 cm dick, unterwärts holzig und daselbst meist entblättert, mit bambusartiger Gliederung in Nodien und Internodien, meist verzweigt. Seitenzweige durchbrechend, büschelig-fächerförmig beblättert, häufig mit Blütenrispen. Blätter meist 20—40 cm lang und 1,5—2,5 cm breit, aber auch kürzer oder länger, schmäler oder breiter, wechselständig-zweizeilig gestellt, an den Triebenden meist zu einem fächerförmigen Blattschopf gehäuft. Blattscheide mit bis zur Basis freien Rändern, den Stengel ± umfassend. Blatthals rinnenförmig; d.h. die beiden Blatthälften nicht miteinander verwachsen. Blattspreite lanzettlich, parallelnervig, am Rande und am Rücken völlig wehrlos. Blütenrispe auf einem wenig ausgeprägten, mit Laubblättern besetzten Rispenstiel, kaum oder nur um $^1/_3$ über die Blätter hinausgehoben. Rispenstiel mit kurzen (ca. 2—5 cm langen) Internodien. Rispenspindel der vollentfalteten Rispen meist zickzackförmig hin- und hergebogen. Tragblätter der untern Rispenäste breit, laubblattähnlich, grün. Rispenäste oft gegabelt. Blütenstiele ± 1—2 cm lang, zu mehreren in kurzen schraubeligen Endinfloreszenzen. Vorblättchen pfriemlich oder fehlend. Blüten sternförmig, blau, weiss oder rot. Staubfäden kropfig verdickt; Antheren im Abblühen sich hakig bis spiralig zurückrollend.

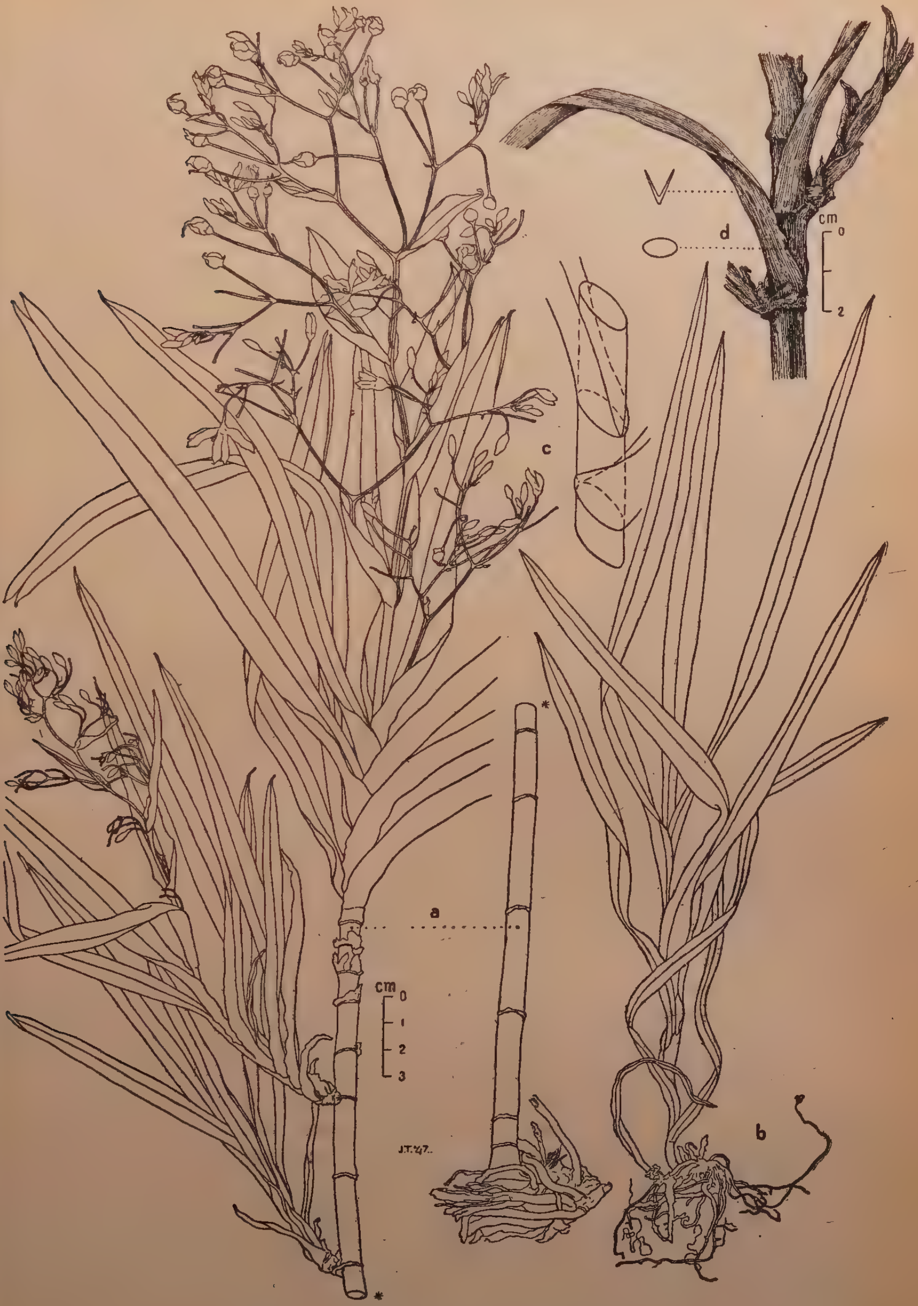


Fig. 1 — *Dianella javanica* (Bl.) Kth.

a) Habitusbild einer mittelgrossen Pflanze. Beachte die breiten laubigen Tragblätter der untern Rispenäste und den kurzen, wenig ausgeprägten beblätterten Rispenstiel — b) Jungpflanze — c) Stengel und Blattscheidenbasis (schematisch). Beachte die bis zur Basis voneinander freien Blattränder der Scheide — d) Stengelpartie mit durchbrechenden Seitentrieben. Stengelquerschnitt elliptisch. Blatthalsquerschnitt v-förmig, rinnenförmig.

b. Verbreitung in Malesien (soweit bis jetzt bekannt)

Sumatra: Nordwestsumatra (Hinterland von Medan, Batak-Hochfläche, Tobameer) Sibulangit: *Lörzing 6133* L! ± 2100 m, *5998* LU! ± 2000 m; Vulkan Sibajak: Bangham *927* GH!, *1040* GH! = f. *alba*, 1500—2000 m. Mittelsumatra (Hinterland von Padang, Barisan-Gebirge, soweit in Res. Sumatra's Westkust gelegen). Plateau Talakmau 2820 m: *Bünnemeyer 971* L!; G. Merapi: *Bünnemeyer 4737* LU! ± 2450 m, *5002* L! ± 2300 m; *Blaauw ohne Nr.* U! 2500—2900 m; *Schiffner 1713* L! Krater 2600 m. G. Singgalang: *Bünnemeyer 2780* L! ± 2800 m, *2710* LU! 2700 m, *2867* L! ± 2500 m; *Jacobson 2794* L! Gipfel 2900 m. G. Malintang: *Bünnemeyer 4117* LU! ± 2260 m. Südostsumatra: G. Kerintji: *Bünnemeyer 10466* LU! ± 2400 m, *10467* L! ± 2400 m, *10446* L! 2500 m. G. Talang: *Bünnemeyer 5505* L! ± 2100—2800 m, *5218* L! ± 2300 m. Barisan-Gebirge in Res. Benkoelen-Palembang: G. Dempo 2900 m: *Jacobson 527* L!. Gouvern. Oostkust van Sumatra: *Yates 1498* L!. *Toroes 590* GH! Karo Highlands. Ohne nähere Standortsbezeichnung: *Forbes 1880* L GH!, *2384*, *2437*b, *Korthals 995* L! u. a. Expl.

Java: Westjava (Hinterland von Batavia, Buitenzorg, Bandoeng): G. Gede: *Blume* 419 L! (*Vulcania glauca* L!, *Dracaena vulcana* L!, *Typen*exemplar L! von der Kraterwand); *Boerlage 35* L!, *Pulle 4161 U!* 2700 m. G. Papandajan: *Van Steenis 4161* L! ± 1860 m; *Boerlage 1888* L! Gipfel. G. Gadjah, Salak, 2200 m: *Bakhuizen v. d. Brink 5127* L GH,! 715 U!. Tjibodas: *Sapiin 305* L!. Provinz Preanger (Priangan): G. Goentoer, Garoet ± 1200 m: *Karsten 54* L!; G. Telagabodas: *Schiffner 1712* L! ± 1600 m. Ohne nähere Standortsangabe: *Zollinger 1967a* Z!, *Korthals* etliche Nr. L!.

Borneo: f. *alba, Clemens 33812* = *33917* L GH! British Nordborneo, Mt. Kinabalu, Colombon-Riv., ca. 3000 m.

Philippinen: Mindanao: *Ramos, Bur. of Sc. 85014* GH!; Negros: *Elmer, 9726* L Z!; Luzon: *Elmer, 8590* L!; *Mearns, Bur. of Sc. 4328 GH L!* ca. 2200 m und 6495 (Benguet); *Gregor, Bur. of Sc. 8478* L GH! (Benguet) und *19671* L!; *Santos, Bur. of Sc. 31837* L!; *Cuming, 929* L!; *Ramos, Bur. of Sc. 42233* Z!, *37636* (Mt. Lumutan), *22192* (Mt. Iriga); *Robinson, Bur. of Sc. 6495* L! (Mt. Mayon); *Williams 1214* GH! (Nord-Luzon), *1533* GH! (Mt. Santo Tomas, Prov. Benguet).

Celebes: Nordost-Celebes (Hinterland von Manado): G. Sapoetan, *Forsten 404* L!; Südwest-Celebes: Latimodjong-Gebirge, ± 2900 m, *Van Steenis Photo* !. Ohne nähere Standortsangabe: *Reinwardt 1391* L!.

Molukken: Ternate: *Beguin 1502* L! ± 1500 m; *De Vriese et Teijsmann ohne Nr.* L!.

Neuguinea: *Schultze 282* vom Augusta-Fluss; selbst habe ich noch keine Exemplare von dieser Insel gesehen.

Ausser Malesien: Mit Sicherheit bekannt von Neukaledonien und Ile des Pins.

c. Wichtigste Formen:

f. *stenophylla* Schl.: Blätter schmal, ± lineal-lanzettlich, unter 1 cm breit. Blüten blau. *Typus 14751a* Z!; ausserdem gehören dazu aus den Philippinen: *Robinson Bur. of Sc. 6495* L!; *Cuming 929* L!; *Ramos Bur. of Sc. 22192* L!; aus Sumatra: *Schiffner 1713* L!; *Jacobson 2794* L!; *Bünnemeyer 971* L! und *2867* L!; ohne nähere Standortsangabe: *Forbes 2384* L!; *2437b* L! u. a. In dieser Form scheint *D. javanica* besonders im Hochgebirge, an der Obergrenze ihrer Verbreitung aufzutreten. Zum Verwechseln ähnlich mit dieser Form sind oft die schmalblättrigen Seitenäste von im übrigen breitblättrigen Pflanzen.

f. *alba* Schl.: Blüten weiss. *Typus Däniker 801* Z!, ferner gehören dazu aus Sumatra: *Bangham 1040* GH!; aus British Nord-Borneo (Mt. Kinabalu, Colombon-River): *Clemens 33812* = *33917* L GH!. Die Form ist wahrscheinlich häufiger als aus den Notizen der Herbaretiketten ersichtlich ist.

f. *rubra* Schl.: Blüten rosa bis rot. Dürfte in Malesien auch vorkommen, bis jetzt nur durch *Däniker* aus Neukaledonien bekannt.

d. Standorte:

Darüber besitzen wir bis jetzt nur sehr spärliche Notizen, die sehr ergänzungsbedürftig sind, auch im Hinblick auf die Vergesellschaftung mit andern Arten. So viel daraus hervorgeht ist *D. javanica* vorwiegend eine Gebirgspflanze (montane Region), niederste bis jetzt vermerkte Fundortsangabe ± 1200 m, höchste Angabe ± 3000 m. *D. javanica* bevorzugt vulkanische Bergkegel mit frischen, steinigen Böden, Lavaströme, Kraterhänge und ähnliche z. T. sehr sterile Böden. Sie gedeiht in lichten buschigen Wäldern, in Waldlichtungen, tritt dort oft bestandbildend auf. In tiefern Lagen ist sie halbstrauchig, verzweigt und entwickelt sich zu über mannshohen Büschen; in Grat- und Gipfelpartien trifft man sie oft als nur ca. 0,5 m hohe Staude. Einige Bezeichnungen und Bemerkungen älterer Autoren sind für die Standorte sehr zutreffend, wie: *Vulcania glauca, Dracaena vulcana* von *Blume*; derselbe schreibt: "*Crescit in Celebes insulae montibus vulcanicis*". *Schiffner* berichtet vom Merapi in Sumatra: "*Regio alpina, ad craterem.*" Für Westjava schreibt er: "*in summo monte Papandajan*" und "*infra lacum vulcanicum Telagabodas*". Karsten fand sie in Mitteljava am G. Goentoer: "op ± 100 jaar oude lavastroom, steenig".

e. Einheimische Namen:

Mit Sicherheit sind keine sich nur auf diese Art beziehende Namen bekannt.

2. **D. nemorosa** Lam. em. Schl.

Wichtigste Synonyme: Solche sind, soweit sie sich auf malesische Formen beziehen, berücksichtigt und bei der Beschreibung der betreffenden Formen genannt (siehe dort).

a. Beschreibung:

Niedriges Kraut oder bis über 1 m hohe Staude, stengellos und mit grundständigem Blattfächer oder mehr oder weniger lang bestengelt mit gleichmässig über den Stengel verteilten Blättern oder mit stengelständigem Blattfächer. Stengel (wenn entwickelt) wenige mm bis über 1 cm dick, in zweikantige oder drehrunde Internodien gegliedert, unterwärts verholzt und daselbst mit Schuppenblättern besetzt oder bis ziemlich weit hinauf entblättert, unverzweigt oder mit kurzen, fächerartig-büschelig beblätterten, oft blühenden Seitentrieben. Stengelinternodien zwischen den Blattbasen hervortretend oder in diesen mehr oder weniger verborgen. Blätter bis über 1 m lang, in Länge und Gestalt sehr veränderlich, von papierdünner, wiesengrasartiger bis zu derb schilfartiger Konsistenz wechselnd. Blattscheiden (der bestengelten Pflanzen) an der Basis kurzröhrig geschlossen, ochreaartig den Stengel umfassend, am Rücken mehr oder weniger gekielt, bisweilen geflügelt, gezähnelt oder wehrlos; an Seitentrieben und stengellosen Pflanzen sind die Ränder der Blattscheidenbasen nur wenig oder nicht miteinander verbunden. Blatthals massiv, d.h. die beiden Blatthälften sind in der deutlich verschmälerten Halspartie teilweise bis fast ganz miteinander verwachsen. Blattspreite von verschiedener Gestalt, meist verlängert-lanzettlich, aber auch kurz lanzettförmig mit grösster Breite in oder unter der Mitte oder seltener eilanzettlich, parallelnervig, derb oder papierdünn, am Rande und am Rücken der Mittelrippe fein gezähnelt oder wehrlos, spitz oder stumpflich und an der Spitze oft zweizipflig eingerissen. Rispe auf einem aus stark verlängerten Internodien bestehenden, oft abgeplattetem Rispenstiel von der Blattregion getrennt, jedoch samt der Rispe dieselbe nicht immer überragend. Rispenstiel mit 1—3 voneinander entfernten, kahnförmig-gekielten Hochblättern besetzt. Rispe gestaltlich und in Grösse sehr verschieden, nicht selten bis auf die Spindel und wenige daran sitzende büschelige Endinfloreszenzen (Schraubeln) reduziert, sonst häufig mit einigen gabelig verzweigten Aestchen. Tragblätter der Rispenäste kurz, schuppenförmig, gekielt oder fehlend. Blüten in büscheligen oder dichten bis locker träubchenartig verlängerten schraubeligen Endinfloreszenzen. Blütenstiele ± 1 cm, dicklich, steiff, oder auch bedeutend länger und dünn, mehr oder weniger gebogen. Vorblättchen oft schwarzbraun, breiteiförmig-langzugespitzt oder pfriemlich oder fehlend. Blüten sternförmig, ± 1 cm, meist blau, violett, rot, weiss oder gelblich. Staubfäden kropfig verdickt; Antheren nicht spiralig zurückgerollt, aufrecht.

b. Verbreitung in Malesien und benachbarten Gebieten (soweit bis jetzt bekannt):

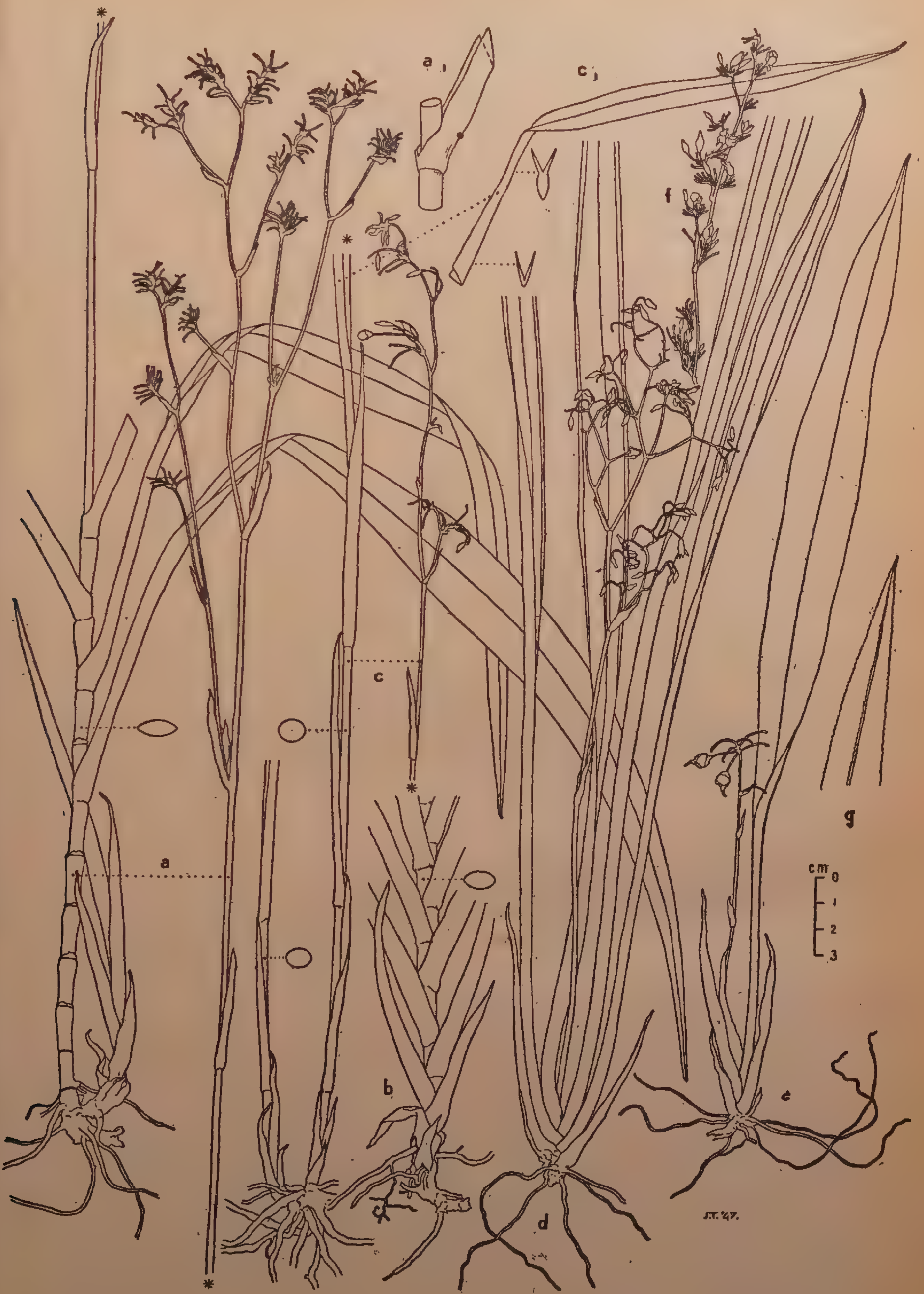
Randgebiete Südostasiens: Burma (nach *Hallier*); Siam (nach *Hallier*); Cochinchina (*Loureiro*); Südchina (Hongkong, nach *Hallier, Bentham* u. a.), Tenasserim (*Gallatly 381* L!); Malaka (*Maingay 1691* L!, f. *montana*); Hainan (*Lei 446* L!, Ching Mai District, Ku Tung village); Formosa = Taiwan (*Tanaka* 1 L! und *Gressitt 446* L U !, Cliff side, Sakahen, Ostküste, ca. 1500 m, beide Nr. f. *racemulifera*); Lantau-Inseln *16496* Z!; Riukiu Ins. Loo Choo (nach *Baker* und *Bentham*); Japan (soll vorkommen).

Sumatra: f. *robusta*: Gouv. Oostkust van Sumatra: *Bartlett 494* L GH! (Asahan); *Atmodjo ohne Nr.* L!; *Toroes 4066* GH!. Gouv. Westkust van Sumatra: *Bünnemeyer 3195* L! (Abt. Agam Brani). Ohne nähere Standortsbezeichnung: *Atmodjo 59* L!; f. *aspera*: Palembang: *Grashoff 380* L!; District Kota Pinang: *Toroes 4066* GH!; f. *pallescens*: Palembang: *Grashoff 566* L!, *518* L! (cult.); f. *tenuifolia*: Djambi: *Posthumus 970* L!.

Java: f. *robusta*: Westjava: Tjibodas: *Raap 635* L! ± 1400 m, *802* L! Weg nach dem Krater 1400—2900 m; *Arsin 53* L!; *Sapiin 99* L!; *Hallier 630* L! zw.

Fig. 2 — *Dianella nemorosa* Lam. em. Schl.

a) Habitusbild einer mittelgrossen unverzweigten Pflanze des *Nemorosa*-Typus (f. *ensifolia, pallescens, montana, robusta, tenuifolia*). Stengel verlängert, mit gestreckten Internodien. Man beachte als Unterschied zu *D. javanica* den langen Rispenstiel mit wenigen, weit voneinander entfernten Hochblattschuppen. Blattstengel (Querschnitt) zweikantig-abgeplattet. a^1) Stengelstück mit der ochreaartig geschlossenen Blattscheidenbasis — b) Blattstengel mit etwas verkürzten Internodien, häufig bei f. *aspera, racemulifera, bancana.* Niederblattschuppen beträchtlich länger als die entsprechenden Internodien. Stengel (Querschnitt) etwas weniger abgeplattet — c) Stengel (ohne den spitzenständigen Blattfächer) und Rispe einer mittelgrossen Pflanze des *Odorata*-Typus (f.*odorata, latifolia, bambusifolia*). Man beachte die stark verlängerten Internodien der Niederblattschuppenzone. Stengel (Querschnitt) schwach abgeplattet oder drehrund. Rispe mit teilweise längern dünnen Blütenstielen. c^1) Einzelnes Blatt aus dem spitzenständigen Blattfächer; Scheide (Querschnitt) v-förmig, rinnig; Hals massiv, Spreite lanzettförmig — d) Habitusbild einer mittelgrossen Pflanze des *Sparsiflora*-Typus (f. *flabellata, carinata, parviflora, albiflora ledermanni, monticola, pullei, sparsiflora, serrulata*). Man beachte den grundständigen Blattfächer. Stengel fast auf null reduziert — e) Habitusbild der f. *monophylla* — f) Blütenrispe der f. *congesta* — g) Rand und Rücken eines Blattes (häufig gezähnelt).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Tjibodas und Tjibeureum. Gede: *Pulle 4161* U! 2700 m; *Schiffner 1714* L! regio nubium, ca. 2600 m. Boerangrang, G. Limoes: *Bakhuizen van den Brink 4397* L! ± 1200 m; Salak: *Raap 211* L! ± 1700 m; Papandajan: *Schiffner 1715* L! ± 2000 m; Bandoeng, Pengalengan: *Smith 789* L! ± 1400 m; Tangkoebanprahoe: *Boerlage* L!. Mitteljava: Res. Madioen, G. Lawoe 2000—2300 m, Südosthang, *Elbert 169* L!. Ostjava: Zuid-Semeroe: *P. Groenhart 203* U!; f. *aspera*: *Hallier 292* L! ohne näheren Standort; f. *pallescens*: Westjava, Res. Batavia: *Hallier 528c* L! Buitenzorg; *Schiffner 1718* L! Buitenzorg, Nangrang, *1719* L! in monte Pantjar, *regio calida*; f. *tenuifolia*: Tjibadak a. d. Halimoen: *Bakhuizen van den Brink 3163* L!; Buitenzorg: *Hallier 528d* L!; ohne nähere Standortsbezeichnung: *Reinwardt* L!, *Zollinger 174* L!; f. *montana*: Geger Bintang: *Blume 491* L! (*Typus*); Tjibeureum (welches?) *Junghuhn* L!; Boerangrang, G. Limoes ± 1200 m: *Bakhuizen v. d. Brink 4397* U!; ohne nähere Angabe: *Bangham 996* GH!. Karimoendjawa-Ins.: f. *aspera*: *Karta 296* L!.

Bangka: f. *bancana*: ohne nähere Standortsbezeichnung: *Amand Typus* Expl. U!. Ostküste: *Bünnemeyer 2241* L! (Bentja ± 100 m), 1616 L U! (Soengailiat ± 90 m), *2113* L U ! (G. Mangol b. Pinang ± 100 m), *2371* L! (Koemboeng, P. Lepar ± 75 m). Westlichster Punkt, Muntok ± 10 m: *Bünnemeyer 1409* L!.

Lingga-Arch.: f. *aspera*: *Bünnemeyer 6904* L! (Pasir Pandjang ± 60 m); *7625* L! (P. Redjai 2 m); *7468* L! (P. Senajan 5 m).

Riouw-Arch.: f. *aspera*: *Bünnemeyer 6360* L! (P. Bintan, S. Poelei); *6470* L! (P. Oedjan, b. P. Bintan ± 10 m).

Karimata-Arch.: *Mondi 221* L! (Poeloe Peloebang).

Borneo: f. *pallescens*: ohne nähere Standortsangabe: *Heutsz 844* U!; f. *aspera*: Niederl. Borneo: *Hallier 1585* L K ! Fuss des Kenepai; *Korthals* mehrere Nr. ohne näheren Standort; *Korthals* ohne Nr. L! (S.O.-Borneo, Gipfel Sakumbang), *Polak 243* L! (Westborneo, Mandor); *Mondi 234* L K ! (Westborneo, Pontianak), *221a* K!, *221b* K!; British Borneo: *Nat. Coll.* 847 L! und 1402 L! (Serawak); *Clemens 30046* L! (Nordborneo), *32234* L! (Mt. Kinabalu); f. *racemulifera*: *Clemens 32234* GH L ! (Mt. Kinabalu, Dallas und *26873* GH! (Mt. Kinabalu).

Philippinen: Palawan: f. *robusta*: *Elmer 12900* L U GH K Z !; *Escritor, Bur. of Sc. 21562*!. Luzon: f. *nana*: *Edaño, Bur. of Sc. 33525* L! Camarines Prov.; f. *gracilis*: *Elmer 22231* L GH Z ! Pampanga Prov., Mt. Pinatubo); *Elmer* und *Merrill 4683* L! (Bugias Prov. of Benguet); *Williams 1049* GH!; *Edaño*, Phil. Nat. Herb. *4653* GH! (Lapit River); *Elmer 16746* GH! (Irosin, Mt. Bulusan, Prov. of Sorsogon; f. *parviflora*: *Edaño 4533* GH! (Tayabas, Prov. Luzon); f. *carinata*: *Ramos, Bur. of Sc. 35067* L! und *30995* GH! (Jamindan Capiz Prov.) Mindanao: f. *aspera*: *Weber 1120* GH! (Butuan Subprov.); Negros: f. *gracilis*: *Elmer 9597* L Z ! (Dumaguete, Cuernos Mts., Prov. of Negros oriental).

Celebes: f. *gracilis*: W.-Celebes, Lombasang ± 1000 m, *Bünnemeyer 11703* L!; f. *odorata*: S.O.-Celebes, Dualo, *Elbert 2963* L!.

Wetar: f. *odorata*: *Elbert 4397* L!, *4421* L!, *4428* L!, *4560* L!.

Molukken: Südmolukken: f. *carinata*: West-Ceram, zw. Loemoli und Lohiatala ± 500—600 m, *Rutten 1570* L!; f. *latifolia*: Soela-Inseln, Taliaboe: *Hulstijn 154* L! (Sanganaua); Amboina: *Zippelius* L!; f. *odorata*: *Robinson 505* L K GH ! (*Gladiolus odoratus indicus*); *Zippelius ohne Nr.* L!; Haruku: *Reinwardt 1457* L! *121* L! und *ohne* Nr. L!.

Neuguinea: f. *odorata*: Niederl. Neuguinea, Süden und Südwesten: *Branderhorst 216* L U !, *194* L ! (Dorf Gelieb). British-Neuguinea, Papua, Fly-River-Gebiet: *Carr 13438* L! (Boridi, ca. 1200 m), *11077* L! (Kanosia); *Brass 7960* A!. *7542* A!, *7959* A! alle Lake Daviumbu, mittl. Fly-River; Western Division: *Brass 6011* A! (Dagwa, Oriomo River), *6552* A! (Mabadun), *8971* A! (Hollandia and vicinity); f. *latifolia*: Westl. Neuguinea (Vogelkop), *Hatusima 12952* A! (Loc. Waren, 60 Meilen südl. von Manokwari); f. *bambusifolia*; Südwest-Neuguinea, Triton-Bai?, *Zippelius ohne Nr.* L! (*Typus*-Expl.); f. *congesta*: British-Neuguinea: *Carr 11158* L! (Kanosia, ca. 20 m); *Brass 3665* A! (Central Division, Rona Laloki-River); f. *flabellata*: Nordwest-Neuguinea, Stromgebiet des Mamberamo (Tarikaikea): *Lam 1045* L B ! 140 m, *812* L ! 130 m. Südwest-Neuguinea, Lorentz-Riv.: *Versteeg 1280* L U !; Nord-Neuguinea, Arfak-Gebirge: *Gjellerup 1146* L U ! 1900 m; f. *carinata*: Nord- und nordöstliches Neuguinea; Stromgebiet des Sepik: *Ledermann 9926* L!; Gogol-Oberlauf: *Lauterbach 1086*, *Hollrung 886* B!; am Etappenberg: *Ledermann 9314a* B!; im Hunsteingebirge: *Ledermann 8464* B!; Lordberg: *Ledermann 9926* B!; Sogeri Region (Ost-Neuguinea): *Forbes 321* L!; Süd-Neuguinea: Hellwigberg 750 m, *v. Römer 872* L!; Lorentz-Riv.: *Versteeg*

1409 L B! (nördl Geitenkamp), *v. Römer 448* L! Geluks-Hügel nordöstl. Alkmaar); f. *ledermanni*: Nordöstl. Neuguinea: *Ledermann 12446* B!; Lordberg: *Ledermann 10065* B! und *10300* B!; f. *albiflora*: Südwestl. Neuguinea: zw. Hellwig-Gebirge und Alkmaar (*v. Römer 707*); Urwald der Ost- und Südostabhänge eines Hügels beim Lorentzfluss (*v, Römer 882*); f. *monticola*: Nordöstl. Neuguinea: *Schlechter 18807* B!, um 2500 m, in den Wäldern des Bismarckgebirges; f. *parviflora*: Nord- Neuguinea: Rouffaer-Rivier, *Dooters van Leeuwen 9817* L! 175 m; *Lam 1838* L B! Mt. Doorman; Idenburg-River: *Brass 12003* A! 1800 m; 15 km südl. Bernhardcamp; Ost-Neuguinea (Papua): *Carr 15149* L! (The Gap); *Brass 11637* A! (Balim-River, 1600 m. Süd- und südwestliches Neuguinea: Triton-Bai?; *Zippelius 168c* L!, *Pulle 617* L! (mont. Dromedaris); f. *pullei*: Südwestl. Neuguinea: Hellwigberg, ca. 1700 m, *Pulle 702 a* und *b* L!; f. *sparsiflora*: *Schlaginhaufen 13* Z!; *Lam 1932* L! 2400 m und *1524* L! 1420 m, beide Mt. Doorman; *Thomson 854* L! (Gebiet des Mamberamo); *Brass 13317* A! (Idenburg-River, 900 m); f. *serrulata*: Nordwest-Neuguinea: *Brass 13424* A! (Idenburg-River 850 m, 4 km SW. Bernhardcamp), *13872* A! (Idenburg-River, 200 m). Papua: *Brass 1430* GH!; f. *monophylla*: Südwesten: *v. Römer 866* (Gebiet des Lorentzstromes); *Janovsky 302* (auf der Kuppe des Jabi-Gebirges, Geelvink-Bai). Nordosten: *Ledermann 9228* B! (Etappenberg), *10300a* B! (Lordberg).

Salomons-Inseln: f. *latifolia*: *Brass 2846* GH! (San Cristoval Island: Waimamura); f. *serrulata*: *Brass 2869* GH! (San Cristoval Island: Hinuahaoro).

Uebrige Verbreitung:

Wir können mit grosser Wahrscheinlichkeit annehmen, dass ausser den 4 Arten *D. javanica, D. dubia, D. boliviana* und eventuell *D. sandwicensis* alle übrigen bisher beschriebenen Dianella-Species in gleicher Weise nur Standortsformen und geographische Rassen der einen Grossart *D. nemorosa* darstellen. Das vorhandene Herbarmaterial ist einzig noch zu klein und zu wenig durchgearbeitet, um alle Uebergangsformen zwischen den habituell verschiedenen Lokalrassen erkennen zu lassen. Für einzelne zwar, wie z.B. für die südostasiatischen und madagassischen Formen kennen wir die Zwischenglieder und dürfen sie ohne weiteres *D. nemorosa* unterordnen. Auch zu mehreren ostaustralischen, melanesischen, neukaledonischen, neuseeländischen und hawaiischen Arten haben sich Uebergangsglieder nachweisen lassen, sodass es, obwohl weiteres Material noch zu studieren ist, als evident erscheint, wenn wir das Grossareal von *D. nemorosa* wie folgt umreissen (näheres siehe Monographie): Maskarenen, Madagaskar, Seychellen, Ceylon, Vorderindien, Himalaya (von Nepal an ostwärts), Khasiaberge, Birma, Siam, Cochinchina, Südchina, Riukiu-Inseln, Japan, Marianen, Carolinen, Sandwichinseln, Malesien, Ostaustralien, Tasmanien, Melanesien, Salomons-Inseln, Neue Hebriden, Loyalti-Inseln, Neukaledonien, Neuseeland, Auckland, Fidji-Inseln, Tonga-Inseln, Gesellschafts-Inseln.

c. Schlüsselartige Gliederung der wichtigsten Formenkreise von *D. nemorosa* Lam. em. Schl.

Mit dieser schlüsselartigen Gliederung wird es möglich sein, die wichtigsten Formenkreise, welche wir als bevorzugte Merkmalskombinationen betrachten müssen, und die bisher häufig als Arten anerkannt waren, mehr oder weniger gut bestimmen zu können.

Die Formenkreise sind unter Kapitel d näher beschrieben (siehe dort), bei gleichzeitiger Angabe der typischen und intermediären Exemplare und Angaben über die Beziehungen der Formenkreise zu einander und über ihr Hauptareal, soweit das uns bis jetzt bekannt ist.

1. Blattscheiden an der Basis deutlich kurzröhrig geschlossen, den Stengel ochreaartig umfassend. Blattstengel kurz oder stark verlängert mit gegen die Basis fächerartig gehäuften, oder über den Stengel mehr oder weniger gleichmässig verteilten oder oberwärts fächerartig gehäuften Blättern. Rispenstiel derb, an Herbarpflanzen oft dunkel- bis rotbraun, auch in getrocknetem Zustande selten so stark eingefallen, dass nicht stellenweise seine ursprünglich zweikantige Form noch erkenntlich wäre.
2. Grösste Blätter bis 1 cm breit. Blütenstiele kurz und dicklich.
3. Stengel mit grösstenteils zweikantig abgeplatteten Internodien. Blattspreite verlängert-lanzettlich.
4. Blätter derb. Blütenrispe mit gedrungenen, stark verkürzten, meist zu 2—(3) dicht an den Nodien stehenden Seitenästchen oder ± sitzenden Schraubelbüscheln . . . . f. **congesta**
4a. Blätter dünn, von wiesengrasartiger Konsistenz. Rispe sehr armblütig, armästig, wenig verzweigt. Aestchen oder sitzende Schraubeln meist einzeln an den Spindelnodien . . . . f. **gracilis**
3a. Stengel unten mit einigen stark verlängerten, drehrunden Internodien. Blattspreite relativ kurz, lanzettförmig . . . . f. **nana**
2a. Grösste Blätter 1,5 cm und breiter, oder wenn schmäler, dann zahlreiche Blütenstiele dünn und lang (über 1,5 cm).
5. Offene Blüten weiss oder gelb.
6. Offene Blüten weiss . . . . f. **ensifolia**
6a. Offene Blüten crèmefarben, weisslichgrün oder gelb f. **pallescens**
5a. Offene Blüten bläulich, blau, violett oder rötlich bis rot.
7. Offene Blüten rötlich bis rot . . . . f. **racemulifera**
7a. Offene Blüten bläulich, blau oder violett (bei f. odorata selten rot).
9. Stengelinternodien in der Laubblattregion und von da abwärts bis zur Stengelbasis abgeplattet (oft mit Ausnahme der 2—3 kurzen untersten).
10. Mehrzahl der Blütenstiele kurz und oft dicklich, steiff oder mehr oder weniger gebogen, bis ca. 1,5 cm lang, bis so lang oder wenig länger als die sich öffnenden Blüten.
11. Blätter mindestens in der Spitzenregion gezähnelt (Die Zähnelung wird infolge der Feinheit und wegen des oft umgerollten Randes leicht übersehen).
12. Endinfloreszenzen der Rispe mehrheitlich stark träubchenartig verlängert, 2 bis über 5 cm lang.
13. Blütenstiele in den träubchenartigen Endinfloreszenzen zu sehr vielen dicht stehend, meist kurz und dicklich . . . f. **montana**
13a. Blütenstiele in den träubchenartig verlängerten Endinfloreszenzen locker, meist ziemlich weit voneinander entfernt gestellt, meist länger (± 1 cm) und ± gebogen f. **racemulifera**
12a. Endinfloreszenzen der Rispe mehrheitlich kurz, büschelig.
14. Stengel stark verlängert, kräftig, unten oft mehr oder weniger entblättert, viele Internodien gestreckt und breit, 2—5 cm lang, deutlich zweikantig abgeplattet, zwischen den Blattbasen hervortretend.
15. Mindestens einzelne Blätter in der Hals-Scheidenpartie scharf gekielt und mit deutlichem (ca. 0,75—3 mm breitem) häutigem, gezähneltem oder glattem, oft auf das tiefere Internodium übergreifendem Flügel; dieses daher in der obern Partie oft scharf zweikantig . . . . . f. **robusta**
15a. Blätter mehrheitlich in der Hals-Scheidenpartie ohne oder mit nur angedeutetem

Flügel, der nicht auf das darunter befindliche Internodium übergreift.

16. Blätter dünn, schlaff, von wiesengrasartiger Konsistenz, oft über 2 cm breit, trocken schwärzlich oder bräunlichgrün f. **tenuifolia**

16a. Blätter derb, von schilfartiger Konsistenz, meist unter 2 cm breit, trocken mattgrün, graugrün . . f. **odorata**

14a. Stengel verkürzt; Mehrzahl der internodien kurz (bis ca. 3 cm) nicht oder nur wenig zwischen den Blattscheiden hervortretend oder wenn Internodien länger, dann die Blätter derb und in der Hals-Scheidenpartie nicht deutlich geflügelt.

17. Stengel bis zu seiner Basis mit stark abgeplatteten Internodien (oft mit Ausnahme der 2—3 kurzen untersten). Blattscheiden braun . . . . f. **aspera**

17a. Stengel unten mit etlichen längern, mehr oder weniger gerundeten Internodien. Blattscheiden und Niederblattschuppen oft mehr oder weniger schwarzbraun bis rostbraun. f. **bancana**

11a. Blätter wehrlos.

18. Blattspreite verlängert, in der Mitte mehr oder weniger parallelrandig. Blattscheiden in der ganzen Länge oft rost-bis schwarzbraun. Schraubeln meist aufgelockert, träubchenförmig verlängert f. **racemulifera**

18a. Blattspreite lanzettförmig, mit grösster Breite in oder unter der Mitte, Ränder überall leicht konvex. Blattscheiden mattbraun.

19. Grösste Blätter bis 2 cm breit f. **odorata**

19a. Grösste Blätter 2—2,5 cm breit f. **latifolia**

19b. Grösste Blätter über 2,5 cm breit, ca. 5—8 mal so lang wie breit . . . . . f. **bambusifolia**

10a. Zahlreiche Blütenstiele lang und dünn, über 1,5 cm, gebogen oder an der Spitze hakig gekrümmt, mindestens 2 mal so lang wie die relativ kleinen Blüten.

20. Blätter wehrlos.

21. Grösste Blätter unter 2 cm breit, schmallanzettförmig bis verlängert . . . . . . f. **odorata**

21a. Grösste Blätter 2—2,5 cm breit, breitlanzettförmig f. **latifolia**

21b. Grösste Blätter über 2,5 cm breit, ca. 5—8 mal so lang wie breit . . . . . f. **bambusifolia**

20a. Blätter gezähnelt (Zähnelung wird infolge der Feinheit oft übersehen).

22. Schraubeln (Endinfloreszenzen) döldchenartig. Stengel fehlend oder vorhanden und dann oberwärts mit abgeplatteten, unterwärts mit einigen ± gerundeten Internodien . . . . . f. **bancana**

22a. Schraubeln aufgelockert, verlängert. Blütenstiele voneinander ± entfernt. Stengel mit abgeplatteten Internodien. Blattscheiden oft in der ganzen Länge schwarzbraunrot . . . . . . f. **racemulifera**

9a. Stengelinternodien in der Niederblattschuppenregion zu mehreren sehr stark verlängert und ± drehrund.

23. Stengel bis 2,5 mm dick, Blütenstand unverzweigt, an der Spitze mit 1—3 genäherten Endinfloreszenzen. Pflanze zierlich . . . . f. **nana**

23a. Stengel über 2,5 mm dick. Blütenstand verzweigt, allermindestens an der Spindel einige voneinander distanzierte Blütenbüschel oder verlängerte Seitenäste.
  24. Grösste Blätter über 2,5 cm breit, ca. 5—8 mal so lang wie breit . . . . f. **bambusifolia**
  24a. Grösste Blätter bis 2,5 cm breit.
    25. Spreite breit lanzettförmig, ca. 2—2,5 cm breit f. **latifolia**
    25a. Spreite schmal lanzettförmig bis verlängert, unter 2 cm breit . . . . f. **odorata**

1a. Blattscheiden bis zur Basis mit freien oder zu unterst nur ganz wenig verbundenen Rändern. Stengel praktisch null (selten bis einige cm lang); die Schuppen- und Laubblätter daher einen grundständigen Fächer bildend oder einzeln grundständig. Rispenstiel weich, meist samt der Rispe kürzer als die Laubblätter, an Herbarpflanzen gewöhnlich stark geschrumpft, längsfurchig eingefallen, vorwiegend strohfarben oder gelblichbraun, seltener rost- oder dunkelbraun.
26. Pflanze mit nur 1—2 Laubblättern von aspidistra- oder convallaria-ähnlichem Aspekt. Spreite ca. 10—12 mal so lang wie breit. Blatthals stielartig lang und schmal . . . . f. **monophylla**
26a. Pflanze mit einigen (selten nur mit 1—2 oder gar keinen) Laubblättern. Spreite 12 bis vielmal so lang wie breit. Blatthals wohl deutlich auf einige mm verschmälert, kurz oder lang, aber nicht ausgesprochen stielartig erscheinend.
  27. Blattrand von der Spreite weg über den Hals bis in den obern Teil der Scheide prominent gezähnelt . . . . f. **serrulata**
  27a. Blattrand nur an der Spreite, seltener auch am Halse, nie an der Scheide gezähnelt oder Blätter völlig wehrlos.
    28. Blätter wehrlos oder nur ganz an der Spitze mit vereinzelten Zähnchen.
      29. Grösste Blätter über 8 mm breit . . . . f. **pullei**
      29a. Grösste Blätter bis 8 mm breit . . . . f. **monticola**
    28a. Blätter mit feinen Zähnchen bewehrt.
      30. Offene Blüten weiss oder gelb.
        31. Offene Blüten weiss . . . . f. **albiflora**
        31a. Offene Blüten gelb, gelblich (bräunlich?) f. **ledermanni**
      30a. Offene Blüten blau, bläulich bis violettrot.
        32. Scheiden-Halspartie bei der Mehrzahl der Laubblätter scharf gekielt mit einem deutlichen, häutigen, prominent gezähnelten Flügelsaum . . . . f. **carinata**
        32a. Scheiden-Halspartie bei der Mehrzahl der Laubblätter ohne oder mit einem glatten Flügelsaum.
          33. Grösste Blätter bis 1,5 cm breit . . . f. **parviflora**
          33a. Grösste Blätter über 1,5 cm breit.
            34. Scheiden-Halspartie bei der Mehrzahl der Blätter schwachgekielt, ohne Flügelsaum . f. **flabellata**
            34a. Scheiden-Halspartie bei der Mehrzahl der Blätter scharf gekielt, mit deutlichem über 0,5 mm breitem Flügelsaum. . . . . f. **sparsiflora**

d. Beschreibung der Formen von *D. nemorosa* Lam. em. Schl., ihre Hauptmerkmale, typische und intermediäre Exemplare:

Die Aufzählung der Formenkreise erfolgt hier im Hinblick auf ihr Areal und der damit von Westen nach Osten feststellbaren Aenderung des Habitus, der Umwandlung der ostasiatisch-indischen Tracht in die neuguineensisch-australe.

A. Sundaplatte:

f. **ensifolia** (L. em. Red.) Schl. — syn. *D. ensifolia* (L.) Red.

Hauptmerkmal: Blüten weiss. Weitere Merkmale: Stengel mehr oder weniger verlängert, mit abgeplatteten Internodien. Blattscheidenbasis ochreaartig geschlossen. Blattspreite ca. 2—4 cm breit, mehr oder weniger gezähnelt. Rispe gabelästig; Schraubeln büschelig. Blütenstiele kurz, ± 1 cm, dicklich, bis so lang oder wenig länger als die Blüten. Abbildungen: Redouté Lil. I (1802) t. I; Gawler in Bot. Mag. XXXIV (1811) t. 1404. Genauere Standortsangaben aus Malesien fehlen bis jetzt. Leitet zweifellos in folgende Form über.

f. **pallescens** Schl.

Hauptmerkmal: Blüten grünlichweiss, crèmefarben oder gelb. Weitere meist zutreffende Merkmale: Stengel gestreckt, kräftig, mit verlängerten, stark zweikantig abgeplatteten Internodien. Blattscheidenbasis ochreaartig geschlossen, Blattspreite derb, breit, 2 bis über 4 cm breit, am Rande und am Rückennerven gezähnelt, zum mindesten spitzenwärts. Rispe locker gabelästig; Schraubeln büschelig; Blütenstiele kurz, ± 1 cm dicklich, so lang oder wenig länger als die Blüten. Typisch *Grashoff 566* L!. Verbreitung: Südostasien und Inselbezirk der Sundaplatte. *Schiffner 1718* L! stellt, durch Verlängerung einzelner Schraubeln, eine Intermediärform zu f. *montana* dar.

f. **montana** (Bl.) Schl. — syn. *D. montana* Bl.

Hauptmerkmal: Endinfloreszenzen stark träubchenartig verlängert, ca. 2 bis über 5 cm lang, mit je vielen gedrängt stehenden, kurzen, dicklichen Blütenstielen. Weitere meist zutreffende Merkmale: Stengel gestreckt, kräftig, mit verlängerten, zweikantig abgeplatteten, breiten Internodien. Blattscheidenbasis ochreaartig geschlossen. Blattspreite schlaff, dünn, 2 bis über 3 cm breit, am Rand und Rücken des Mittelnerven gezähnelt. Rispe locker gabelästig. Blüten blau. Vorkommen: Südostasien und Inselbezirk der Sundaplatte. *Typus: Blume 491* L! (besonders die eine Rispe ist charakteristisch, während die andere desselben Bogens durch die kürzern Schraubeln schon zu andern Formen überleitet). Sehr typisch im Blütenstand ist *Maingay 1691* L!, während die derben Blätter mehr an f. *pallescens* erinnern. Durch das Auftreten vieler schlaffblättriger Exemplare leitet f. *montana* über zu f. *robusta*. *Bangham 996* GH! hat durch den sehr kurzen, praktisch fehlenden Stengel und den dadurch grundständigen Blattfächer sparsifloraähnliches Aussehen.

f. **robusta** (Elm.) Schl. — syn. *D. robusta* Elm.

Hauptmerkmal: Scheiden-Halspartie scharf gekielt, mit einem deutlichen, häutigen, gezähnelten oder wehrlosen Flügel, der meist auf das untere Internodium übergreift. Weitere meist zutreffende Merkmale: Stengel kräftig, gestreckt, mit verlängerten zweikantig abgeplatteten Internodien, meist über 5 mm breit. Blattscheidenbasis ochreaartig geschlossen. Blattspreite lang, 2 bis über 3 cm breit, ziemlich dünn, am Rand und Rücken des Mittelnerven gezähnelt, trocken schwärzlich oder braungrün. Rispe locker gabelästig. Schraubeln büschelig, Blütenstiele kurz, ± 1 cm dicklich. Blüten blau. Vorkommen: Inselbezirk der Sundaplatte und Philippinen. *Typus: Elmer 12900* Z!, weitere Exemplare davon in L, K, GH; sehr typisch auch *Sapiin 99* L! u. a. Die Form geht durch Verschmälerung des Flügels allmählich in f. *tenuifolia* über. Belegexemplare von *Kuhl* und

Van Hasselt aus dem westlichen Java leiten durch träubchenartige Verlängerung der Schraubeln auch in f. *montana* über. *Schiffner 1715* L! hat in der Rispe mit dünnern, längern Stielen schon Anklänge an f. *bancana*.

f. **tenuifolia** Schl. nov. f. — Caulescens; caulis elongatus, compressus. Folia laxa, late graminea, denticulata; vagina basi tubulosa; carina non alata; lamina tenuis, in sicco plerumque nigrescens. Flores caerulei, in bostricibus fasciculatis dispositi. Pedicelli ± 1 cm longi.

Hauptmerkmale: Schlaffe, dünne, meist über 2 cm breite, trocken bräunlich- oder schwarzgrüne Blattspreiten, deren Rand- und Rückenkiel gezähnelt sind. Blattscheide und Hals weniger scharf gekielt und nicht oder nur andeutungsweise geflügelt. Weitere meist zutreffende Merkmale: Stengel gestreckt, mit verlängerten, breit abgeplatteten Internodien. Blattscheidenbasis ochreaartig geschlossen. Schraubeln büschelig. Blütenstiele ± 1 cm. Blüten blau. Vorkommen: Inselbezirk der Sundaplatte und Philippinen. *Typus: Posthumus 970* L!. Die f. *tenuifolia* steht der f. *robusta* sehr nahe und geht einerseits in diese, anderseits auch in f. *gracilis* über.

f. **aspera** Schl.

Hauptmerkmale: Stengel verkürzt, mitunter praktisch fehlend. Internodien kurz, abgeplattet, in den Blattbasen verborgen oder nur wenig hervortretend. Blätter zu einem dem Erdboden genäherten Fächer zusammengedrängt. Meist ist der Stengel auch zur Blütezeit der Pflanze noch bis zur Basis beblättert, mit einigen grundständigen Niederblattschuppen. Blattscheidenbasis ochreaartig geschlossen. Spreiten ca. 1,5 bis 2,5 cm breit, derb, trocken bräunlichgrün, Rand und Rücken des Mittelnerven zerstreut gezähnelt, gelegentlich ist der Rückenkiel bis zur Blattspitze wehrlos, seltener sind auch die Blattränder fast wehrlos. Rispe gabelästig; Schraubeln büschelig; Blütenstiele kurz, ± 1 cm, Blüten blau. Vorwiegend Borneo, aber auch auf andern Inseln der Sundaplatte. *Typus: 1585* K! Folgende Nrn. zeigen bei Vergleich eine Uebergangsserie von kurzstengeligen *Aspera*-Exemplaren zu länger bestengelten Exemplaren, die zu den f. *robusta, pallescens, montana* überleiten: *Mondi 221* L! (Karimata-Arch.), *Bünnemeyer 7468* L! (Lingga-Arch.), *6360* L! (Riouw--Arch.), *6904* L! (Lingga-Arch.), *7625* L! (Lingga-Arch.), *Weber 1120* GH! (Mindanao). Intermediär zu f. *odorata* sind: *Korthals 78* L! (Borneo) bezügl. Blattform und Blattfarbe, *Grashoff 380* L! bezügl. Blattform, Blattfarbe und Konsistenz, *Karta 296* L! (Java) bezügl. Blattform (lanzettlich), Blattfarbe (mattgrün). Anklänge an f. *bancana* zeigen viele Exemplare durch etwas längere und dünnere Blütenstiele, z. B. *Korthals 99* L!, *Nat. Coll. 847* L!. Die f. *aspera* hat durch Exemplare mit etwas verlängerten Schraubeln auch Beziehungen zu f. *montana,* durch hellblaue Blüten solche zu f. *ensifolia* und f. *pallescens.* Sie stellt durch die derben Blätter und den im allgemeinen etwas weniger abgeplatteten Stengel, wie auch durch ihr Hauptareal in Borneo, ein Verbindungsglied zu f. *odorata* dar.

f. **bancana** (Miq.) Schl. — syn. *D. bancana* Miq.

Hauptmerkmale: Blütenstand gracil, die Endinfloreszenzen döldchenartig oder büschelig mit je einigen dünnen und langen (1,5 cm und längern)

Blütenstielen, die mindestens 2 mal so lang sind wie die relativ kleinen Blüten. Weiter meist zutreffende Merkmale: Spreite verlängert, in der Mitte mehr oder weniger parallelrandig, derb, am Rand und Rücken des Mittelnerven gezähnelt, ca. 1,5 cm bis 2,5 cm breit. Stengel praktisch fehlend (Typenexemplar) oder entwickelt und oft sogar ziemlich lang. Die Internodien in der Laubblattregion sind stark abgeplattet, in der Niederblattschuppenregion weniger abgeplattet, mehr oder weniger gerundet. Die f. *bancana* vereinigt bei bestengeltem Wuchs in sich einige Merkmale der westlichen Formen, nämlich: den zweikantig-abgeplatteten Stengel mit breiten langen Blättern (*Nemorosa*-Merkmale) und einige Merkmale der östlichen Formen, nämlich: den gracilen Blütenstand mit langen dünnen Stielen der f. *odorata* (*Odorata*-Merkmale). Blüten blau. Vorkommen: Bangka und wohl über Borneo bis in die Philippinen. *Typus: J. Amand ohne Nr.* U!, stellt einen zur Blüte gelangten Ausläufer dar. Die nachstehenden Sammelnummern zeigen den Zusammenhang des unbestengelten Typenexemplares mit bestengelten Exemplaren, letztere leiten zugleich über in die f. *robusta, pallescens, racemulifera* u.s.w.: *Bünnemeyer 1409* L!, *2113* L!, *2241* L!. *Bünnemeyer 1616* L! leitet durch die schon etwas kürzern, in Büscheln geordneten Blütenstiele über zu Exemplaren von f. *aspera*, wie zu *Polak 243* L! (West-Borneo). Etliche Exemplare der f. *bancana* zeigen im Blatt-Typus intermediären Charakter zu Exemplaren der f. *odorata*. *Bünnemeyer 2371* L! nähert sich, was die Blätter betrifft sehr der f. *racemulifera*. *Haviland ohne Nr.* L! von Nord-Borneo steht bezüglich den Blättern gewissen Exemplaren der f. *aspera* nahe, z. B. der *Nr. 234* L! von *Mondi* aus Pontianak (West-Borneo). Auch die Blütenstände gleiten habituell aus der f. *bancana* allmählich in den Habitus der f. *aspera* über.

f. **racemulifera** Schl.

Hauptmerkmale: Entweder Schraubeln locker träubchenartig verlängert mit ziemlich weit voneinander entfernten, dünnen, gebogenen Blütenstielen oder wenn die Schraubeln gedrängter und Blütenstiele kürzer, dann mindestens die Laubblätter wehrlos und Blattscheiden oft schwarzbraun. Blüten rot. Die Form umfasst Pflanzen mit wehrlosen und mit gezähnelten Blättern. Den Uebergang zwischen diesen zwei auf den ersten Blick verschiedenen Exemplaren zeigt uns *Clemens 26873* GH! deren Blätter einen fast wehrlosen Rückenkiel und nur zerstreut gezähnelte Ränder besitzen. Vorkommen: Südostasien und Borneo. *Typus: Nr. 1* Z!. Die f. *racemulifera* hat Beziehungen zu f. *bancana* (*Bünnemeyer 2371* L!), sowie zu f. *aspera* (durch oft kurzen Stengel und derbe Blätter), ferner zu f. *odorata* (durch dünne und lange Blütenstiele).

B. Philippinen, Celebes, Molukken, Neuguinea:

f. **gracilis** Schl.

Hauptmerkmale: Ganze Pflanze schmächtig. Stengellos oder mehr oder weniger lang und dünn bestengelt. Stengel abgeplattet bis fast drehrund. Blätter lang und schmal, kaum mehr als 1 cm breit, meist dünn, von wiesengrasartiger Konsistenz, selten derber. Blattscheidenbasis deutlich ochreaartig geschlossen. Spreite am Rand und Rücken des Mittelnerven gezähnelt. Rispe klein, wenigästig, mit nur wenigen, sitzenden Schraubeln. Blütenstiele kurz, ± 1 cm, dicklich oder auch länger und dünner. Blüten blau. Vorkommen: Philippinen, Celebes. *Typus: Elmer 22231* Z!. Die Form lässt deutliche Beziehungen zu f. *tenuifolia* erkennen. *Elmer* und *Merrill 4683* L! (Luzon) und *Bünnemeyer 11703* L! (West-Celbes) leiten deutlich zu der *Sparsiflora*-Gruppe über, am meisten nähern sie sich der f. *carinata*. *Elmer 16746* GH! und *Edaño 4653* GH! sind intermediär zwischen kleinen Exemplaren der f. *tenuifolia* und solchen der *Sparsiflora*-Gruppe. Das im Gray Herbarium liegende Co-Typen Exemplar *22231*! und *Williams 1049* GH! schaffen durch den schwach abgeplatteten Stengel mit in der Niederblattregion stark verlängerten Internodien Beziehungen zu f. *odorata*.

f. **odorata** (Bl.) Schl. — syn. *D. odorata* Bl.

Hauptmerkmale: Gracile Rispe, deren Schraubeln je einige dünne (über 1,5 cm lange) Blütenstiele besitzen, die mindestens 2 mal so lang sind wie die Blüten. Die Blätter sind lanzettförmig, bis gegen 2 cm breit, meist wehrlos, trocken mattgrün. Weitere Merkmale, die oft zutreffen: Stengel in der Schuppenblattregion mit stark verlängerten, drehrunden Internodien. Niederblattschuppen kürzer bis wenig länger als die entsprechenden Internodien. Blüten lichtblau, blau, violett und rot. Vorkommen: Philippinen?, Celebes, Molukken, Neuguinea. *Typus: Blume ohne Nr.* L! fig. *Rumph. optima*; ähnlich ist *Reinwardt 1457* L! von Haruku. Sehr typisch bezüglich des Stengels, mit unterwärts stark verlängerten, mehr oder weniger drehrunden Internodien sind *Brass 8971* A!, *7959* A!, *7960* A!, *7542* A! u. a. *Brass 7959* A! vereinigt in ein und demselben Blütenstand Endinfloreszenzen mit dicken kurzen Blütenstielen, nebst solchen mit dünnen langen Blütenstielen, was zeigt, dass selbst diesem Merkmal kein grosser diagnostischer Wert zukommt. Bei den meisten *Brass-Nrn.* sind die Blattspreiten (unten) etwas gezähnelt. Durch weniger gestreckten Stengel mit Schuppenblättern, die beträchtlich länger sind, als die relativ kurzen Internodien, weichen *Reinwardt 121* L! und *Brass 6011* A! ab. *Branderhorst 194* L! (Gelieb) weist durch den stark abgeplatteten, unten entblätterten Stengel und die Rispe mit kurzen Blütenstielen stark auf *aspera*artige und *robusta*artige Pflanzen der Philippinen hin. Auch die scharfe feine Zähnelung, die sich an den Blättern jener Pflanze findet, weist auf die Blätter der letztgenannten Formen hin. *Carr 11077* L!, aus Papua, hat nicht wehrlose, sondern ziemlich rauhe, gezähnelte Blätter. Der ganze Charakter der f. *odorata* wird nach Osten immer *caerulea*-ähnlicher und dies auch in mikroskopischen Merkmalen; so zeigen z. B. die Stengelinternodien bei *Brass 7542* A!, *7959* A! auch schon die papillösen Epidermiszellen von *D. caerulea* Sims, wenn auch noch nicht in der Menge, wie sie die Exemplare der letztern Art zeigen, die aus Südostaustralien kommen.

f. **latifolia** Schl. nov. f. — Caulescens; caulis ± teres; internodia inferiora et media elongata. Folia in apice caulis flabelliforme aggregata; vagina basi tubulosa; lamina rigida, ± inermis, late-lanceolata (2—2,5 cm lata). Flores caerulei, violacei vel rubri.

Hauptmerkmale: Blätter derb, ± wehrlos, breit-lanzettförmig, ca. 2 bis 2,5 cm breit und relativ kurz. Stengel in der Schuppenblattregion mit gestreckten mehr oder weniger drehrunden Internodien. Blütenstiele dünn, lang, 1,5 cm und mehr. Vorkommen: Neuguinea, Molukken, Salomons-Inseln. *Typus: Zippelius ohne Nr.* L!. *Brass 2846* GH! von den Salomons-Inseln (Waimamura) weicht ab durch kurze, kaum 1 cm lange, in Büscheln stehende Blütenstiele und spitzenwärts etwas gezähnelte Blätter. Sie zeigt, wie fliessend der Uebergang zu f. *bambusifolia* ist. Sehr breitblättrig ist *Kanehira 12952* GH! aus West-Neuguinea. Die f. *latifolia* stellt bezüglich Blattbreite, Blattform und bezüglich der Blütenstiele, die aus der langen dünnen Gestalt in die kurze dickliche, steife übergehen, das Mittelglied zwischen f. *odorata* und f. *bambusifolia* dar.

f. **bambusifolia** (Hall. f.) Schl. — syn. *D. bambusifolia* Hall. f.

Hauptmerkmale: Blätter breit-eilanzettlich, die grössten über 4 cm breit, derb, wehrlos oder ganz an der Spitze etwas gezähnelt, etwa 5 bis 8 mal so lang wie breit, trocken mattgraugrün. Stengel in der Schuppenblattregion mehr oder weniger drehrund, mit Niederblattschuppen besetzt. Blütenstiele kurz, bis 1 cm, steiff, in Büscheln. Der Charakter der Stiele ist zwar sicher veränderlich. Vorkommen: Neuguinea. *Typus: Zippelius ohne Nr.* L!. Die f. *bambusifolia* ist nichts anderes als eine extrem breit- und kurzblättrige Wuchsform der f. *odorata*.

f. **nana** Schl. nov. f. — Planta gracilis; caulescens. Caulis usque 2,5 mm crassus; internodia inferiora et media elongata, teretia. Folia ca. 5—10 mm lata, lanceolata, denticulata. Inflorescentia pauciflora, non ramosa, in apice 1—3 bostricibus. Pedicelli elongati, tenues. Flores plerumque caerulei.

Hauptmerkmale: Pflanze bestengelt, schmächtig, mit dünnem, bis ca. 2,5 mm dickem Stengel. Internodien in der Niederblattschuppenzone sehr stark verlängert, mehr oder weniger drehrund. Blätter bis 1 cm breit, lanzettförmig, derb, gezähnelt. Rispe auf 1 bis 3 spitzenständige Schraubeln reduziert. Blütenstiele lang (1,5 cm und länger), dünn, gebogen. Diese Form ist eine zwergige Ausbildung der f. *odorata*. Vorkommen: Philippinen. *Typus: Ramos Bur. of Sc. 33525* L!.

f. **congesta** (R. Br.) Schl. — syn. *D. congesta* R. Br.

Hauptmerkmale: Rispe schmal, gedrungen, besonders die Seitenästchen stark verkürzt, sodass die büscheligen Schraubeln eng zusammengedrängt der Spindel genähert sind. Blütenstiele sehr kurz, unter 1 cm, dicklich, zu dichten Büscheln gedrängt. Blüten blau oder fast weiss. Weitere Merkmale: Bestengelt; Stengelinternodien in der Laubblattregion stark verlängert, abgeplattet, in der Niederblattschuppenzone kürzer, weniger abgeplattet, mehr oder weniger gerundet. Niederblätter zur Blütezeit meist noch vorhanden, rostbraunschwarz. Laubblätter derb, kaum über 1 cm breit; Scheiden-Halspartie steil-schief-aufwärts-abstehend, Spreiten mit scharf gezähnelten, oder nur rauhen, seltener wehrlosen Rändern. Vorkommen: Südost-Neuguinea. *Typus ?* Diese Form hat am stärksten australes Gepräge und nähert sich sehr der australischen *D. caerulea* Sims, in anderer Weise aber der f. *odorata*.

f. **flabellata** (Hall. f.) Schl. — syn. *D. flabellata* Hall. f.

Praktisch stengellos. Blätter meist zu mehreren (5—10) in grundständigem Fächer; Rücken der Scheiden-Halspartie mehr oder weniger gekielt, aber ohne Flügel; Spreite über 1,5 cm breit, meist lang, Rand und Rückenkiel gezähnelt. Rispenstiel meist dünn, weich, an trockenen Pflanzen häufig längsfurchig eingefallen. Blüten blau. Pflanzen meist kräftig. Vorkommen: Neuguinea. *Typus: G. Versteeg 1280* L! Da an ein und demselben Exemplar die Blätter bald schwächer, bald stärker gekielt sind und sogar andeutungsweise geflügelt sein können, ergeben sich alle Uebergänge zu f. *carinata.* Auch Uebergänge zu andern Formen sind bekannt.

f. **carinata** (Hall. f.) Schl. — syn. *D. carinata* Hall. f.

Praktisch stengellos. Blätter vorwiegend zu 2—4 in einem grundständigen Fächer. Rücken der Scheiden-Halspartie stark gekielt und mit deutlichem, gezähneltem, häutigem Flügelsaum versehen. Rispenstiel meist dünn, an trockenen Pflanzen längsfurchig eingefallen, meist strohgelb. Blüten blau. Vorkommen: Neuguinea, Molukken, Philippinen. *Typus: G. Versteeg 1409* L!. Die Blattzahl sinkt oft auf zwei. Die Flügelbreite zeigt alle Abstufungen von breit bis schmal, von stark gezähnelt bis fast wehrlos, sodass ein lückenloser Uebergang zu f. *flabellata* u. a. vorliegt. Die Trennung ist rein künstlich.

f. **parviflora** (Hall. f. ex Zipp. ms.) Schl. — syn. *D. parviflora* Hall. f. ex Zipp. ms.

Praktisch stengellos. Blätter meist zu 2—4 in grundständigem Fächer, schmal, höchstens 1,5 cm breit, Rücken der Scheiden-Halspartie ohne oder mit schmalem Flügelsaum; Spreite von weicher bis derber Konsistenz, mehr oder weniger stark gezähnelt. Rispenstiel dünn, trocken längsfurchig eingefallen. Rispe klein; Blüten blau. Vorkommen: Neuguinea, Philippinen. *Typus: Zippelius 168* L!. An den drei Exemplaren dieses Bogens sieht man sehr schön die Reduktion der Blattzahl; die Pflanze rechts hat 4 Laubblätter, die mittlere 2, die links noch 1. Solche Reduktionen zeigt aber nicht nur die f. *parviflora,* sondern man trifft sie auch bei allen andern Hallierschen Arten (*Sparsiflora*-Gruppe), sodass eine graduelle Stufung bis zu f. *monophylla* ersichtlich ist. Bezüglich der Blattspreite kennt man alle Uebergänge zu den breitblättrigen Formen.

f. **albiflora** (Hall. f.) Schl. — syn. *D. albiflora* Hall. f.

Praktisch stengellos. Blätter zu wenigen in einem grundständigen Fächer, besonders spitzenwärts gezähnelt. Rispenstiel dünn, trocken längsfurchig eingefallen. Blüten weiss. Bezüglich aller Merkmale lassen sich Uebergänge zu den andern Formen finden. Auch die weissen Blüten sind nicht trennend, weil Exemplare mit milchweissen und hellblauen vorkommen, die zu solchen mit blauen Blüten überleiten. Vorkommen: Neuguinea. *Typus: v. Römer 882* L!

f. **ledermanni** (K. Krause) Schl. — syn. *D. Ledermanni* K. Krause.

Wie vorige Form und nur durch die mehr gelblichen bis gelben (braunen?) Blüten verschieden. Vorkommen: Neuguinea. *Typus* lag im Herb. Berlin, zerstört.

f. **monticola** (K. Krause) Schl. — syn. *D. monticola* K. Krause.

Praktisch stengellos. Blätter zu wenigen in einem grundständigen Fächer, wehrlos, schmal, bis 8 mm breit. Rispenstiel dünn, trocken längsfurchig eingefallen. Rispe locker, mit relativ langen Blütenstielen. Vorkommen: Neuguinea. *Typus* nie gesehen.

f. **pullei** (K. Krause) Schl. — syn. *D. Pullei* K. Krause.
Praktisch stengellos. Blätter zu wenigen in grundständigem Fächer, wehrlos, über 8 mm breit. Rispenstiel dünn, trocken längsfurchig eingefallen, samt der Rispe kürzer als die Blätter. Rispe klein. Vorkommen: Neuguinea. *Typus: Pulle 702* L! Diese Nr. zeigt, dass auch kleine, nur mit Schuppenblättern versehene Ausläufer zur Blütte gelangen können. Auch an andern Formen der *Sparsiflora*-Gruppe macht man dieselbe Feststellung. Wenn wir solche schuppenblättrigen Exemplare nicht im Zusammenhang mit beblätterten finden, so sind wir nicht imstande, sie bei der oder jener Form mit Sicherheit einzuordnen.

f. **sparsiflora** (Schl.) Schl. — syn. *D. sparsiflora* Schl. s.str.
Praktisch stengellos. Blätter zu mehreren bis einem einzigen grundständig; Rücken der Scheiden-Halspartie bei der Mehrzahl der Blätter scharf gekielt, mit deutlichem wehrlosem Flügel; Spreite über 1 cm breit, Rand und Rückennerv gezähnelt. Blüten blau. Vorkommen: Neuguinea. *Typus: Schlaginhaufen 13* Z!. Die Form geht lückenlos in f. *carinata* u. a. über. *Thomson 854* L! besitzt als blühende Pflanze nur 1 grundständiges, breites Blatt. Dadurch, dass die Lamina alle Variationen von sehr lang und schmal bis zu kurz und breit aufweist, ist die Beziehung zu f. *monophylla* unverkennbar.

f. **monophylla** (Hall. f.) Schl. — syn. *D. monophylla* Hall. f.
Stengel praktisch fehlend; nur 1 grundständiges Laubblatt vorhanden (Expl. mit 2 solchen sind auch bekannt). Blätter von *convallaria*- oder *aspidistra*-ähnlichem Aspekt. Blatthals schmal, lang, stielartig; Spreite nur ca. 10—12 mal so lang wie breit. Pflanze im allgemeinen zierlich, mit sehr dünnem, schwachem Rispenstiel und sehr kleiner Rispe. Durch Verlängerung der Spreite, durch das Auftreten von mehr als einem Blatt, durch grösser werden der Exemplare sind alle Uebergänge in die andern Formen des *Sparsiflora*-Typus verwirklicht. Vorkommen: Neuguinea. *Typus: v. Römer 866* L!.

f. **serrulata** (Hall. f.) Schl. — syn. *D. serrulata* Hall. f.
Stengel praktisch null; Blätter zu mehreren in grundständigem Fächer. Ränder im obern Teil der Blattscheide prominent gezähnelt. In den andern Merkmalen erinnert die f. *serrulata* sehr an f. *flabellata*, f. *carinata* u. a. Die Zähnelung der Blattränder ist ganz allgemein ein sehr schlechtes Kriterium. Vorkommen: Neuguinea, Salomons-Inseln. *Typus: K. Gjellerup 71* L!

e. Standorte der *D. nemorosa* und ihrer Formen:

Auch bei dieser Art wissen wir über Standorte und Vergesellschaftung sehr wenig. Sicher ist aber, dass diese Art eine grosse Vertikalamplitude hat, und dass sie befähigt ist Standorte zu besiedeln, die edaphisch und klimatisch sehr verschieden sind, was sich im Formenreichtum wiederspiegelt.
Tiefste Standorte: Meeresniveau; höchste Standortsangaben 2700 m

(G. Gedeh auf Java und Mt. Doorman auf Neuguinea). Die Art steigt wohl noch höher.

Schiffner und *Raap* erwähnen die Pflanze vor allem aus vulkanischen Gegenden mit jungen, steinigen Böden, wie von den Kratern des Papandajan und des Gede. Die f. *robusta*, f. *tenuifolia* und andere dünnblättrige Formen gedeihen jedenfalls in feuchten Gebieten (hohe Luft- oder Bodenfeuchtigkeit). *Schiffner* gibt für f. *robusta* an: "regio nubium"; aber auch feuchte Tiefländer (regio calida) beherbergen diesen Typus. Die f. *pallescens*, f. *ensifolia* sind bis jetzt mehr aus dem Innern von Urwäldern bekannt und scheinen Formen zu sein, die den Waldesschatten bevorzugen. Nebst diesen gibt es ausgesprochene Lichtformen, die in lichten Busch- und Hochwäldern, in steinig-felsigen Hangwäldern, in Savannenwäldern, in Hartgrasfluren auf Plateaus, in Grat- und Gipfelpartien gedeihen. Ebenso werden Erdanrisse, Bachbette und andere Bodenblössen, Waldschläge u.s.w. häufig von *D. nemorosa* besiedelt. Die Pflanzen treten in kleinern und grössern Beständen, in Herden oder zerstreuten Horsten auf. Im südöstlichen Neuguinea sind besonders die Hartgrasfluren der Savannenwälder und die trockenen Hangwälder in Süd- und Südostlage die Standorte der f. *odorata* und der f. *congesta*; auch die f. *serrulata* wird von ähnlichen Standorten vermeldet, kommt aber auch in geschlossenen Urwäldern vor. Ausser auf Roterdeböden und steinig-felsigen, mancherorts aus vulkanischer Asche bestehenden Böden kommt *D. nemorosa* auch in feuchten, moosigen Waldböden, an nassen triefenden Felsen und dergleichen humiden Standorten vor. Vor allem die Sparsifloragruppe besiedelt mehr schattige moosige Wälder, wo die Pflanzen in Herden oder truppweise, seltener einzeln auftreten.

Vorwiegend die Wald- und Tieflandformen neigen zu hellblauen und weisslichen Blüten, während die Formen lichter Hang-, Savannen- und Gebirgswälder intensiv blaue, violette oder rote Blüten haben. Pflanzen aus feuchten und schattigen Waldgebieten haben im allgemeinen dünne, schlaffe Blätter; Pflanzen von steinigen, sonnigen Orten sind derbblättrig und die Blattränder und der Kiel sind oft rot angelaufen. Wald- und Graslandformen der tiefern Region sind mehr oder weniger lang bestengelt, während die Gebirgsformen und die neuguineensischen Waldformen stets niedriger bleiben. Die Verzweigung des oberirdischen Stengels wird bei niedrigerem Wuchs der Pflanzen immer mehr in die Wurzelstockregion verlegt, indem hier viele durchbrechende Triebe entstehen und zu Horsten führen, oder es bilden sich Ausläufer, die ein herdenartiges Auftreten der Pflanzen bewirken.

f. Einheimische Namen (z. T. nach: F. A. S. De Clercq, Nieuw Plantk. Woordenb., 2de dr., 1927).

Boengaraja (batak); *d(e)wangga* (balin.); *djamaka, djambaka, djampaka* (soend.); *djos* (balin.); *edjos* (sasak); *sesiak, siak-siak, siak-siak djantan* (mal.); *sijek-sijek* (minangk.); *taghari* (madoer.); *tegari* (javan.); *toendau* (mal. Bangka); *mentoendil* (Bangka, Soengailiat); *oehop* (Bangka, Pinang); *toendaun* oder *tengari* (Bangka, Bentja).

g. Ueber die Formenbildung bei der linnéischen Art *D. nemorosa* Lam. em. Schl.

Wenn ich meinen Eindruck über diese interessante Species in Kürze wiedergebe, so ist es folgender:

Wir haben hier den Fall, wo dieselbe Erbmasse gegenwärtig über ein riesengrosses Areal verbreitet ist und in dessen Teilgebieten Abwandlungen nach den verschiedenen Richtungen erfährt, die aber selten so weit gehen, dass der sichtbare Zusammenhang mit der Erbmasse abreisst. Es ist ein gegebener Merkmalssatz vorhanden, dessen Elemente, wie bei einem Zusammensetzspiel immer wieder zu neuen Kombinationen gefügt werden, gelegentlich geht aber eines dieser Elemente verloren und wird durch ein anders ersetzt.

Die Art befindet sich gegenwärtig in einer Entwicklungsphase, in der sich aus der gegebenen dianelloiden Merkmalskombination, an den verschiedensten Stellen Neubildungen herauskristallisieren, bei denen der Hiatus zur ursprünglichen Merkmalskombination fehlt. Wir sagen, die Glieder fliessen ineinander. Das Ineinanderfliessen geschieht aber nicht direkt, sondern über den Ursatz an Merkmalen.

Nebst der Kombination alter Elemente zu neuen Gebilden, sehen wir aber auch deutlich wie das einzelne Element, das einzelne Merkmal in den Teilgebieten des Grossareals Abwandlungen unterworfen ist, die so weit gehen, dass es mitunter verschwindet und oft durch ein neues ersetzt wird.

Wir haben daher — in den heute durch Meer voneinander isolierten Teilarealen — nebst vielen entstehenden Parallelbildungen auch tatsächliche Neubildungen. Im ganzen vollzieht sich die Weiterentwicklung in lauter parallel nebeneinander aufsteigenden Linien, die einerseits entstehen aus der Kombination der Merkmale des ursprünglichen Satzes, anderseits dadurch, dass effektive Neubildungen sich in ähnlicher Weise in weit voneinander entfernten Gebieten wiederholen. Wir sehen eine Entwicklung aus der Urform heraus ins Neue und aus dem Neuen ein Rückfliessen in die Urform hinein, ein Kreislauf.

Der ursprüngliche Merkmalssatz, soweit wir von einem solchen überhaupt sprechen dürfen, wird immer weiter verzettelt, auf immer mehr parallel aufstrebende Aeste verteilt, und in diesen Aesten werden immer mehr der ursprünglichen Merkmale ausgelöscht und wenn das letzte verschwindet, dann erscheint der Hiatus — mit andern Worten — die "gute Art".

Bei der Gattung *Dianella* findet sich in dieser Hinsicht eine ganz allmähliche Abstufung. Sie führt im oben beschriebenen Sinne von kaum erkennbaren, lokalen Formenschwärmen über immer deutlicher sich abhebende Formenkreise (wie Odorata- und Sparsiflora-Typus) bis zu der durch den Hiatus getrennten Art. Letztere gibt sich uns scharf begrenzt zu erkennen. Es besteht aber die Möglichkeit, dass sie aus irgendwelchen Gründen ins Fluktuieren gerät und dass ihre Varianten sich überschneiden, und dann beginnt der Kreislauf von neuem.

Bei den malesischen Dianellen liegt der Sonderfall vor, wo ein starrer nebst einem labilen Typ das gleiche Areal besiedeln.

Während der erstere uns überall im gleichen Kleide entgegentritt, sehen wir beim zweiten, wie er in den Teilarealen artenähnliche Kristallisationszentren erzeugt, die sich, vergleichsweise, kegelartig aus der Grundmasse erheben und sich in der Spitzenpartie deutlich als Art zu erkennen geben, während sie an der Basis diffus in alle andern Zentren überfliessen.

Zwei Beispiele sollen das Gesagte noch etwas ergänzen:

Als erstes zeigt sich bei dieser Grossart deutlich wie ein Element, nämlich die träubchenartig verlängerte Schraubel, in ganz entfernten, isolierten Gebieten immer wieder zum Durchbruch gelangt, also Parallelen bildet. Die verlängerte Schraubel tritt immer wieder in Verbindung mit einer andern Kombination der übrigen Merkmale auf. Bezeichnend ist sie für *D. nemorosa* f. *montana* in Malesien, ähnlich wiederholt sie sich aber auch bei *D. nemorosa* f. *mauritiana* auf Madagaskar und ebenso bei neukaledonischen und australen Formen.

Als zweites liefert uns *D. nemorosa* auch ein Beispiel dafür, wie eine effektive Neubildung, wie wir sie im Wuchs und Habitus des *Sparsiflora*-Typus sehen, sich in ähnlicher Weise in weit entfernten Gebieten wiederholt. Der *Sparsiflora*-Typus hat auf Neuguinea sein Massenzentrum, er tritt uns aber in ähnlicher Weise entgegen auf Celebes, auf den Philippinen und auf Madagaskar. Zum mindesten im letztgenannten Gebiet dürfen wir als sicher annehmen, dass er aus einem Stammgut von *D. nemorosa* entstand, das infolge der grossen räumlichen Entfernung auch zeitlich schon längst getrennt und sicher genetisch schon anders orientiert war.

Würden wir diese isolierte Parallelbildung (wie sie durch *Lam 5347* L! aus Madagaskar dokumentiert wird) auf Grund ihrer frappanten morphologisch-anatomischen Aehnlichkeit kurzweg zum neuguineensischen *Sparsiflora*-Typus zählen, so wäre dieser, man darf wohl sagen, erwiesenermassen polymorph; man kann sie aber auch nicht, wie das vorläufig doch geschehen ist, der f. *gracilis* zuzählen.

Im allgemeinen sind wir gar nicht imstande zu sagen, ob eine morphologisch-anatomische Kombination zeitlich und räumlich denselben Ursprung hat. Trotzdem fassen wir, unbewusst der grossen Differenz, gleichartige Bildungen als systematische Einheiten zusammen. Ihr Charakter ist aber heterogen, polymorph. Die ersten Ansätze zur Polymorphie liegen schon in der Art. Sie ist schon eine polymorphe systematische Einheit und je grösser ihr Areal und je grösser die Aufsplitterung und Isolierung der Stücke ist, um so mehr Parallelen treten auf, die wir vom morphologisch-anatomischen Gesichtspunkte als reelle Einheiten betrachten, in Wirklichkeit sind es aber Einheiten polymorphen Charakters.

VI. DIE VERWANDTSCHAFTSBEZIEHUNGEN DER GATTUNG DIANELLA UND EINIGE PFLANZENGEOGRAPHISCHE TATSACHEN.

Beweise fehlen uns, um sagen zu können — es ist so, und nicht anders — aber es gibt auch Wahrscheinlichkeiten, die durch Häufung vieler Einzelfälle so viel an Bedeutung gewinnen, dass sie vom wirklichen Geschehen nicht allzuweit entfernt sein können. Eine solche Wahrscheinlichkeit liegt auch für die Verwandtschaftsbeziehungen der Gattung *Dianella* vor.

Wenn wir das Grossareal der Gattung grob umreissen, so liegt es innerhalb der Linie, die von Madagaskar über die Seychellen, Ceylon, Nepal, Japan, nach den Hawaii-Inseln verläuft und von letzteren über Venezuela, Peru, Neuseeland, Tasmanien, Ostaustralien nach Madagaskar zurückführt.

Die Gattung *Dianella* zeigt im Areal, auf den durch grosse Ozeane geschiedenen Inseln und Kontinenten 5 Hauptzentren, die durch einen enormen Formenreichtum sich von den Randgebieten abheben. Drei von den 5 Hauptzentren entfallen auf Malesien, nämlich eines, wohl das stärkste, auf die Landschollen der Sundaplatte (mit dem *Nemorosa*-Typus), ein zweites, etwa gleich starkes auf Neuguinea und die benachbarten Inseln (mit dem *Sparsiflora*- und dem *Odorata*-Typus) und ein drittes, entschieden schwächeres auf die Philippinen (mehr charakterisiert durch Mischtypen und Zwergformen als durch einen eigentlich vorherrschenden Typus). Die beiden aussermalesischen Zentren liegen in Südostaustralien und auf Neukaledonien. Die Eckpunkte des Grossareals von *Dianella* sind meist nur von einer einzigen Art mit wenigen Formen besiedelt, so Madagaskar und die Maskarenen von *D. nemorosa*, die Sandwichinseln von *D. sandwicensis*, das tropische Südamerika von *D. dubia* und *D. boliviana*.

Das für die Gattung umrissene Grossareal ist zugleich auch das Verbreitungsgebiet einiger anderer Gattungen mit dianelloiden Merkmalen und noch mehr, es ist auch das Areal, welches den indirekten Vorläufern von *Dianella* zugekommen sein muss. Wenigstens sind etliche Restgattungen darin heute noch enthalten und z. T. weit verbreitet.

Als indirekte Vorläufer von *Dianella* müssen wir aus arealgeographischen und morphologischen Gründen die Gattungen *Geitonoplesium* A. Cunn., *Eustrephus* R. Br. und *Stypandra* R. Br. (*St. glauca* R. Br.) ansehen. Besonders *Geitonoplesium* lässt über die alte Sippe der *Luzuriagoideen* noch Beziehungen zu Gattungen Südamerikas erkennen, wie solche bei *Dianella* noch innerhalb der Gattung zum Ausdruck kommen. *Eustrephus* zeigt mehr Beziehungen zu den malayisch-afrikanischen Genera, aber auch zu den sundaischen Dianellen; *Stypandra* endlich hat in Australien ihre Entwicklung genommen, steht aber durch *St. glauca* R. Br., die nur eine verkleinerte Ausgabe von *D. javanica* ist, der Gattung *Dianella* sehr nahe.

In *St. glauca* wiederspiegelt sich unverkennbar der dianelloide Typ. Sie ist aus dem gleichen Stammaterial entsprungen wie *D. javanica*, die wir zu den Urformen der malesischen Dianellen zählen müssen.

Die Differenzen zwischen all den genannten Genera sind sehr gering, wie das schon im Charakter der Liliaceensystematik liegt, wo kleine Unterschiede genügen, um Genera voneinander abzugrenzen, wie das auch aus der frühern Einschätzung von *D. javanica* als *Rhuacophila javanica* Bl. hervorgeht.

Wir haben bei *Dianella* den Fall, bei dem wir ausgehend von den heutigen Vertretern, dank vieler intermediärer Formen, noch einen Blick in die Tiefe des Entwicklungsgeschehens haben, wie er uns nicht allzu oft so klar geboten wird.

So wie *D. javanica* arealmässig und morphologisch-anatomisch indirekte Beziehung— zu den Gattungen *Stypandra, Eustrephus* und *Geitonoplesium* aufweist, so können wir *D. javanica* über *D. sandwicensis* und *D. boliviana* mit der Grossart *D. nemorosa* verknüpfen. Wie die Differenzierung innerhalb der letztern vor sich schritt und noch schreitet, wie sie in viele, nicht durch den Hiatus getrennte Lokalformen, von denen einzelne gut erkennbare geographische Rassen darstellen, aufgesplittert ist, das haben uns die vorherigen Kapitel gelehrt. Ebenso wurde dort gezeigt, welche Beziehungen zwischen diesen Formen bestehen. Abschliessend ist nur noch auf einige pflanzengeographische Tatsachen hinzuweisen; d.h. zu erwähnen, welche dieser Formen für die drei malesischen Zentren bezeichnend und teilweise sogar auf ein einzelnes Zentrum beschränkt sind.

Die 3 malesischen Dianella-Zentren fallen im übrigen zusammen mit den Zentren, die man auch aus vielen andern Gattungen kennt, und die in der Arbeit von H. J. Lam "Phylogeny of the Malaysian Burseraceae-Canarieae", Blumea III, 1935, p. 146, beschrieben sind als Sunda-Land, Wallacea (wovon Philippinen, Molukken Teilgebiete darstellen) und Sahul-Land.

Für das Sunda-Land ist der Nemorosa-Typus kennzeichnend, mit: f. *ensifolia, pallescens, montana, robusta, tenuifolia, aspera, racemulifera, bancana.* Einige davon gehen bis in die Philippinen.

Für die Wallacea sind in den Philippinen einige Zwergformen bezeichnend, wie f. *gracilis*, f. *nana* und andere Mischtypen, die vom *Nemorosa*-Typus in den *Odorata*- und den *Sparsiflora*-Typus überleiten. Die Philippinen tragen bezüglich der Gattung *Dianella* mehr den Charakter eines zwischen West und Ost vermittelnden Gebietes, in dem Beziehungen zu Formen der Inseln der Sundaplatte wie zu solchen der Molukken, Celebes und Neuguineas bestehen. Für die Molukken ist, allerdings nicht allein, der Odorata-Typus mit f. *odorata* und f. *latifolia* bezeichnend. Daneben aber sind schon die *sparsiflora*-artigen Dianellen vertreten. Aehnliche Verhältnisse sind auf Celebes.

Für das Sahul-Land, worunter hier vor allem Neuguinea gemeint ist, ist der Sparsiflora-Typus sehr bezeichnend mit: f. *flabellata, carinata, parviflora, albiflora, ledermanni, monticola, pullei, sparsiflora.* Nur im südöstlichen Neuguinea treffen wir Formen (wie f. *congesta*), die schon sehr an die australen Typen erinnern. Die f. *congesta* stellt geradezu das verbindende Glied zum australen Caerulea-Typus dar.

Die ganze Differenzierung in der Gattung lässt sich mit den arealgeographischen Verhältnissen nur in Einklang bringen, wenn wir das Alter der Gattung als kretazeisch annehmen und sie als ein Glied des altozeanisch-austral-antarktischen Elementes betrachten.

THE IDENTIFICATION OF WOOD SPECIES WITH THE AID OF THE HOLLERITH SYSTEM.[1]

by

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I. INTRODUCTION.

The last few years investigations in the field of wood anatomy have been strongly directed towards finding a universal system of identifying wood species. The problem has, however, not yet been solved definitively.

What is to be understood by a universal method and in what respects it differs from other systems, may be summarized as follows:

1) A universal system of identification allows of increasing the number of wood species included indefinitely.
2) This implies that the key does not include wood species from only one particular geographical area, but samples from all continents.

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[1] This paper was presented at the meeting of the International Association of Wood Anatomists at Oxford in July 1947.

3) The system should make it possible for characteristics and wood species to be simply arranged according to different points of view.
   A likely arrangement is one by:
   a. Structural features.
      It should be possible to select species with e.g. cribriform perforation plates, included phloem and similar structural features.
   b. Physical and chemical features.
      Specific gravity, hardness, colour, and the presence of certain substances such as lapachol and flavone might be included.
   c. Systematic units.
      Representatives of an order, family, genus and species should be easy to collect from the total number of samples described.
   d. Geographical distribution.
      In many cases it is desirable to have a survey of the wood species originating from a particular continent or from a particular country, in so far as they occur in the system.
4) It should be possible for the identifications to be made with a pocket lens as well as with a microscope.

It will be consented that a system of identification which meets the above demands should preferably make use of loose cards, each card bearing the features of one wood species.

At the moment two types of card indexes are in use, an English system designed by Clarke (1938) and a Dutch system designed by Pfeiffer and Varossieau (1945).

Other principles were developed by Swain (1927), Bianchi (1932) and Beversluis (1943).

The scheme of Clarke has been applicated in Australia (Dadswell and Eckersley, 1941) and France (Normand 1946).

Phillips (1941) elaborated it for the identification of Coniferous woods.

The idea of a card index key has also been suggested in the field of entomology (Diakonoff 1941).

Besides the similarity of making use of loose cards, the English and Dutch identification methods for wood species differ in their procedure which, in each case shows certain advantages and certain drawbacks. These will be dealt with under II.

The object of this paper is to present a procedure of the Dutch system which combines the advantages of both.

A similar work has been started in the U. S. Forest Products Laboratory at Madison, Wisconsin.

The author owes many thanks to the late Dr J. Ph. Pfeiffer, formerly Director of Research of the Laboratory of the N. V. de Bataafsche Petroleum Mij., Amsterdam, for his important suggestions and for the way in which he has made this investigation possible.

Many thanks are also due to Mr Swaab (Head of the Financial Dept. of the B. P. M. Laboratory te Amsterdam) and to Mr Groeneveld (representative of the International Business Machines Co., Amsterdam) for the many technical details which they gave the author about the procedure and application of the Hollerith system.

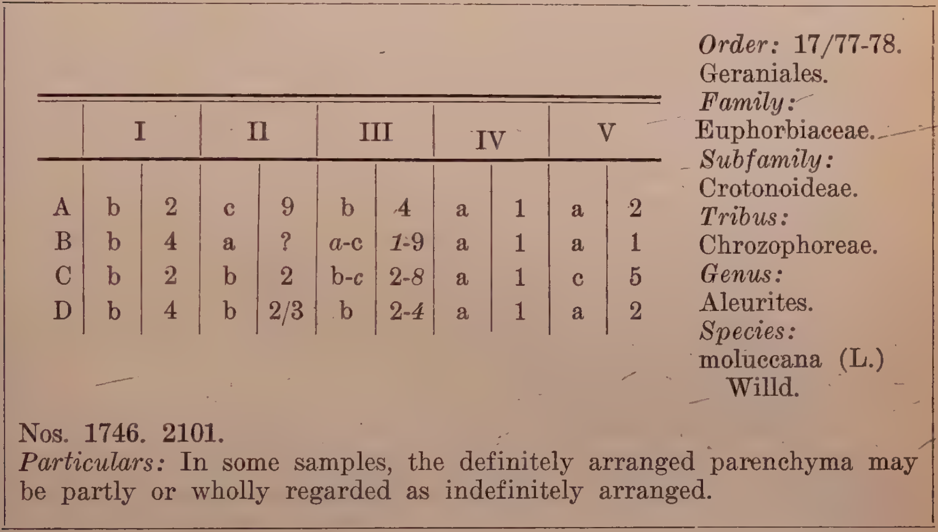
II. COMPARISON OF THE ENGLISH AND THE DUTCH UNIVERSAL METHOD OF IDENTIFICATION.

A. Procedure of the two systems.

In the Dutch scheme of identification the structural elements of woods are described according to a decimal system.

Five classes of features are each of them divided into four groups, and these again into subgroups, which are indicated by means of indices. It is the intention that the classification of wood species should give a grouping which links up as well as possible with the botanical arrangement according to a natural system.

On the classification scheme is based a method of identification which makes use of loose cards (*Fig. 1*). This enables the number of wood species to be enlarged constantly. The cards are not perforated, as is mostly the case with other systems of identification using loose cards, on the ground of the consideration that the classification originally designed by Pfeiffer was also intended for the use of private persons, such as foresters, engineers and wood merchants, for whom the use of a perforating machine and selecting box would be a drawback.



	I		II		III		IV		V	
A	b	2	c	9	b	4	a	1	a	2
B	b	4	a	?	*a-c*	*1*-9	a	1	a	1
C	b	2	b	2	b-*c*	2-*8*	a	1	c	5
D	b	4	b	2/3	b	2-*4*	a	1	a	2

Order: 17/77-78.
Geraniales.
Family:
Euphorbiaceae.
Subfamily:
Crotonoideae.
Tribus:
Chrozophoreae.
Genus:
Aleurites.
Species:
moluccana (L.)
Willd.

Nos. 1746. 2101.
Particulars: In some samples, the definitely arranged parenchyma may be partly or wholly regarded as indefinitely arranged.

Fig. 1 — Card for identification key according to Pfeiffer and Varossieau (1945). Actual size of card 12,5 × 7,5 cm.

By means of a table symbol combinations representing features are converted into a group of two figures, according to which the cards are arranged. To identify a wood species, its features are stated on a card, after which that card is taken from the system which corresponds to the combination of figures which can be deduced from these features.

The English system of identification (Clarke 1938) also employs loose cards (*Fig. 2*), but these are perforated along the edges. Each hole in the card corresponds to a particular feature. These holes run on as far as the edges of the card only if the wood species described on it shows the feature in question. If a rod is pushed through a hole in the complete set of cards, only the cards showing this feature fall out on shaking.

This operation is repeated until one card is left bearing the name of the species required.

B. Comparison of advantages and drawbacks.

During a discussion which the author had with a number of English I. A. W. A. members in June 1946, the following points were put forward:

1) Though under the Dutch method the number of wood species included can be extended constantly by adding new cards, the same method must each time be followed to make an identification. In other words, the field covered by the system is unlimited, but the method itself is fixed. In the English method it is possible to determine for each individual case what is the quickest way of arriving at an identification; the order of the features used in identificatian is not fixed in this case. As against this, it is often difficult to make a choice from the features if the order in which they are to be considered has not been laid down. This has become clear in Bianchi's system, which has no fixed procedure either. In this method it proved necessary to find a solution for the problem.
2) Some investigators deny the possibility of combining an arrangement of the cards according to relationship of the species with an arrangement determined by the wood structure. This objection is based on the supposition — an incorrect one according to the author — that there is a botanical system which is capable of describing the relationship between species accurately. If it is agreed that this is not the case, a different classification of species based on the wood structure, in comparison with a (mainly) morphological system, might give new indications of this relationship. In actual practice this has repeatedly been found possible.
3) The numerical combination according to which the cards are arranged in the Dutch system is obtained by combining 3 features for the first number, and 6 features for the second number.
   This makes it difficult to find out how a certain feature is distributed over various systematic units.
   In connection with what has been said under 2), it may be remarked that it is very important that the numbers determining the order of the cards should have been obtained by a combination of features. For it is in the first place combinations of features which give indications about the relationship and not these features separately.
   Some advantages of the Dutch system over the English are:
4) A card with the dimensions of the "international library size" (taken from the first international postcard size: 125 × 75 mm), in

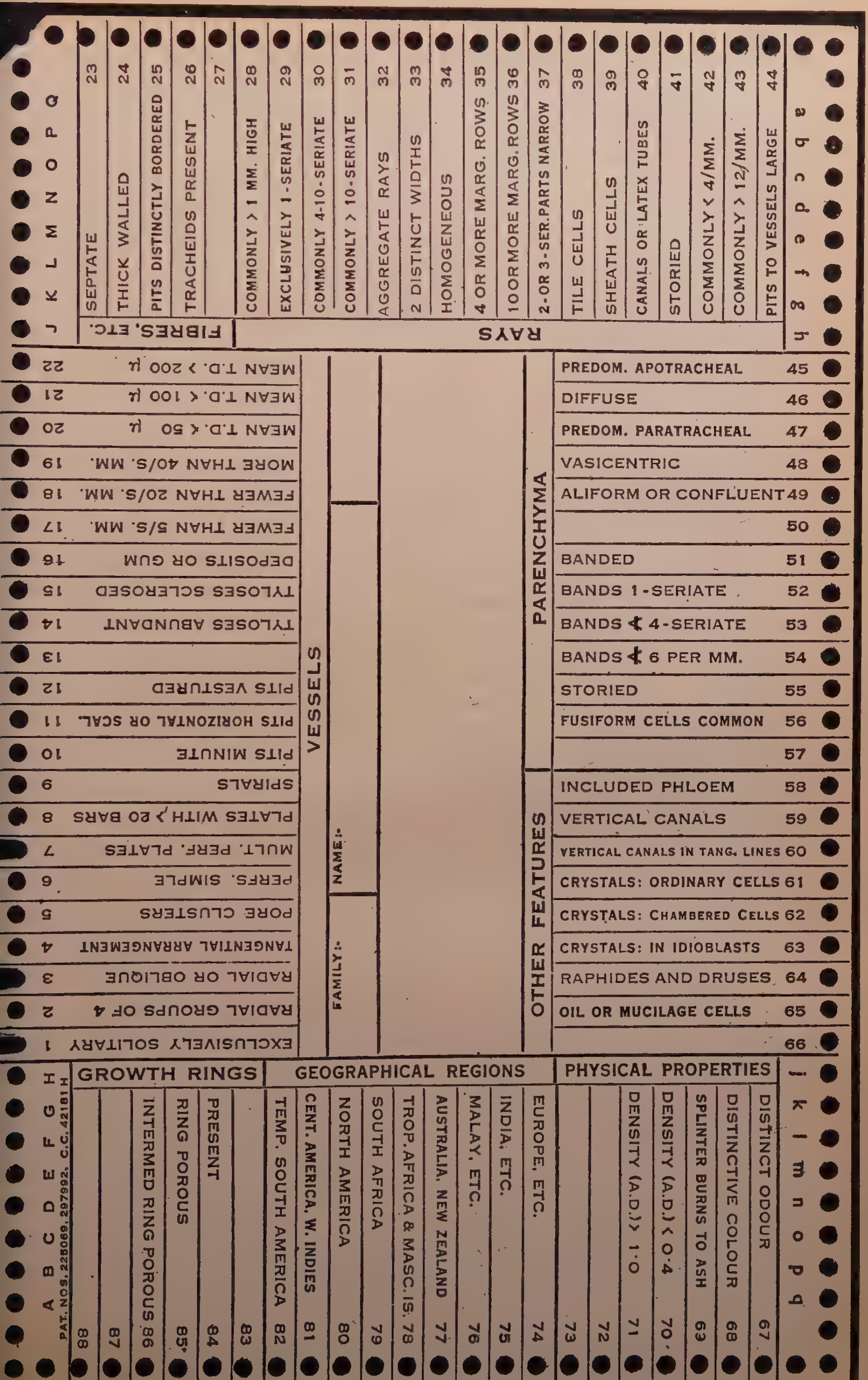


Fig. 2 — Lay-out of card for multiple entry key according to Clarke (1938). Features 1, 3 and 7 are shown notched. Actual size of card 20 × 12,5 cm.

case symbols are used, can bear many more features than the English cards, though these have larger dimensions (200 × 125 mm).

5) The Dutch cards bear only those features which are shown by the wood described.
The English cards always contain all features, but the majority of them — in each card separately — are never used.

6) Unlike the English system, the Dutch system classifies the features in a staggered manner. This method prevents subordinate features from being placed on the same level as those, covering a wider field.
For convenience the differences between the English and Dutch methods are recorded in the following table.

Comparison of the English and Dutch methods of identification.

Points compared	English method	Dutch method
1. Number of features	limited, influenced by size of card	unlimited, not influenced by card size
2. Arrangement	features next to each other	features staggered
3. Symbols	features are not represented by symbols	features are represented by symbols
4. Punching	features are punched into the cards	features are not punched

The way in which the advantages of the two methods can be combined will be discussed under III.

III. DESIGN OF A UNIVERSAL IDENTIFICATION KEY ACCORDING TO THE HOLLERITH SYSTEM.

A. Some general remarks on the procedure of the Hollerith system.

1. PRINCIPLE

The Hollerith system makes use of groups of features representing different criteria of examination. These criteria can be combined in a variety of ways, and for this reason the method is excellently suitable for use in a universal method of classification and identification.

The features of each group are represented by symbols (figures or combinations of figures), and these are punched into a card.

The card contains eighty columns (numbered 0—80), each consisting of 10 figures (0—9).

Each group of features embodies one or more of such columns.

As a general rule, only one figure may be punched per column.

If more than one figure must be employed per column, two cards should be used. These only differ in that the one figure is punched into the first card, and the other figure of the same column into the second card.

Even if they differ from each other in some respects, one or more duplicates of cards can be made in a cheap and easy manner. This operation is quite automatic, and takes place by means of a master card.

An exception to the above rule (the use of one figure per column) is the representation of the letters of the alphabet, which result from punching two symbols per column.

Here, use is made of the eleventh and twelfth punching positions on the unprinted strip at the top of the card. The entire alphabet can thus be represented in 26 columns (9 + 9 + 8 columns) (*Fig. 3*). Letters may be placed in any column.

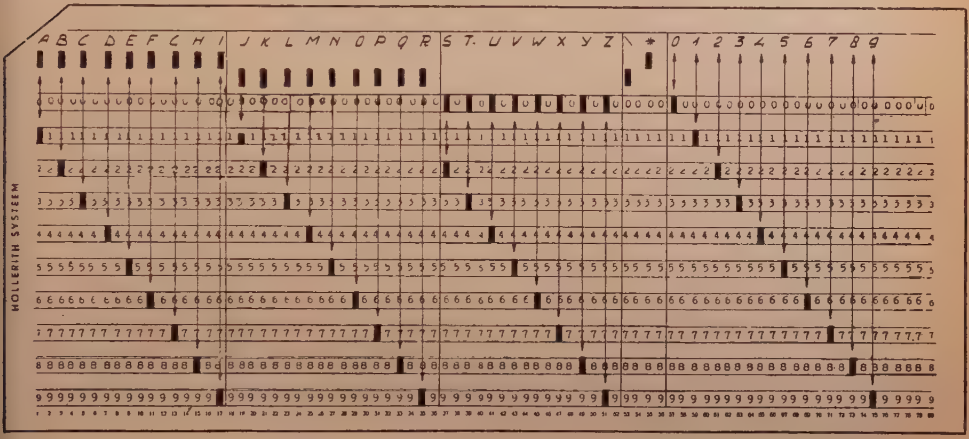


Fig. 3 — Indication of letters and numbers in a Hollerith card. Actual size of card 18,7 × 8,3 cm.

2. MACHINES.

The operation of a card index according to the Hollerith principle requires the use of three types of machines:

a. A punching machine.

Series of numbers representing definite features are punched into the cards by means of this apparatus. If necessary, particular columns which one wants to reserve, may be skipped automatically.

A punched card is checked on a second apparatus, so that errors are easily detected.

b. A sorting machine.

This machine sorts cards according to any desired column. If a pack of cards is run through the machine a number of times, these can be sorted according to feature groups and their subdivisions.

c. A tabulating machine.

This apparatus registers the number of times which a certain feature or feature group occurs in a set of cards. The numbers are recorded automatically.

Some machines are moreover capable of "translating" feature symbols into legible letters.

Further information on the Hollerith system and other card-sorting techniques are given by Casey, Bailey and Cox (1946) and Cox, Casey and Bailey (1947). Benjamin (1947) worked out a possibility of multiple-punching with Hollerith machines.

The application of punched cards, which were originally designed for administrative purposes, to scientific problems is a.o. illustrated by Eckert (1947), King (1947) and Morgan and Frear (1947). The present writer (1947) dealt with the use in literature documentation, with special reference to wood species.

B. Lay-out of features.

The card model now designed (*Fig. 4*) includes botanical systematic data, distribution areas and macroscopically perceptible features as criteria for selection. Further, a number of columns have been left open for stating native and Latin names in ordinary letters.

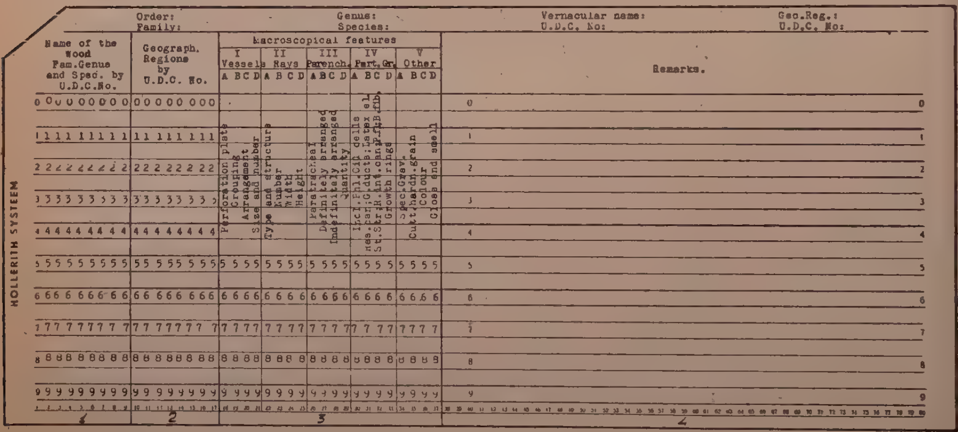


Fig. 4 — Hollerith card, designed for the identification of wood species with the aid of a hand-lens. The lay-out of the columns 18 to 37 included is given in the publication quoted under fig. 1.

In connection with the operations to be performed by the tabulating machine, each of the above group of features must be numbered. The groups are indicated by the figures 1 to 4 incl. These figures only serve as an indication of a definite section of the card, and they are therefore unconnected with the figure combinations describing a certain feature in each group.

1. TAXONOMICAL DATA.

These are stated on the card as feature group 1.

2. THE DISTRIBUTION AREA.

This has been given as feature group 2.

The way in which the groups 1 and 2 are subdivided will be explained under IV.

3. MACROSCOPICALLY PERCEPTIBLE STRUCTURAL FEATURES are combined in feature group 3.

All the data relating to such features begin, therefore, with the figure 3.

The arrangement of this group is based on the above-mentioned system developed by Pfeiffer and Varossieau (1945, p. 447), the features of which, provided with a group and code number, are repeated below.

In this way the following survey is obtained:

31. Vessels.
    311 Perforation plate
    312 Grouping
    313 Arrangement
    314 Diameter and number

32. Rays.
    321 Types and structure
    322 Number
    323 Width
    324 Height

33. Parenchyma.
    331 Paratracheal
    332 Definitely arranged
    333 Indefinitely arranged
    334 Quantity

34. Particular growths.
    341 Included phloem, oil cells
    342 Resin canals, gum ducts and latex elements
    343 Storied structure, radial intercellular canals, pith flecks and bast fibre formations.

35. Other characteristics.
    351 Specific gravity
    352 Cutting hardness and grain
    353 Colour
    354 Gloss and smell.

Each of the above features are divided into ten possibilities, marked 0 to 9 incl. For a description of these indices, see the 20 tables of the publication in question.

Each of the 200 features mentioned in these tables can therefore be indicated symbolically by means of three figures the figure 3 preceding as indicating the group.

Twenty columns are necessary to indicate macroscopically perceptible structural features.

4. VERNACULAR AND LATIN NAMES IN LETTERS.

In a fourth group the names of the wood species to which the card relates can be indicated by alphabetic symbols if desired.

Inclusive of spaces between words, max. 43 columns can be used for this purpose, which is more than sufficient in most cases.

As said above, modern tabulating machines are capable of indicating these names in legible letters at the top of the card. This is especially important in connection with the manifolding of cards.

In this way, the names stated, can also be reproduced automatically.

Otherwise the blank right hand side of the card may be used for stating any information desired both in handwriting or in typeriting. These data may include mechanical properties, literature references and so on.

C. Comparison with other systems.

An operation of the Dutch method of identification according to the Hollerith system allows of combining advantages of the procedures described under II.

A system of symbols is used as a result of which a great many features can be included, the mutual relations of which are shown. An additional advantage is the fact that the punching system enables a selection to be made according to any feature desired.

The procedure of the above system is limited in that use must be made of expensive machines, which will only pay if employed regularly and at full capacity.

This drawback might be met by making cards at a central office and sending duplicates to various countries at a remuneration.

For carrying out identifications or phylogenetic studies use may be made of machines which are in operation at large concerns for administrative purposes.

IV. APPLICATION OF THE UNIVERSAL DECIMAL CLASSIFICATION FOR THE INDICATION OF BOTANICAL AND GEOGRAPHICAL FEATURES.

A. Some general remarks on the U. D. C.

The U. D. C. is a classification designed as an aid in arranging data by subjects.

The term *universal* is meant to indicate that the system covers the entire field of human knowledge, and that the subjects can be grouped according to any point of view.

This is the principal point in which it differs from other systems of classification, which consider it possible to arrange subjects according to separate branches of science.

The term *decimal* denotes that the subjects are divided into 10 groups, every one of these again into 10 groups, and so forth.

The decimal character of the arrangement is not of fundamental interest; significant is the fact that subjects of unequal importance are grouped in subordination to each other.

Not all numbers 0—9 indicating the subdivision of a group are as a rule used, but some places are usually left open, which make a subsequent extension possible.

Sometimes a centesimal arrangement is desirable, i. e. if the number of equivalent subjects in a group is far higher than 10.

In some cases, as with the classification of families in the botanical system, the entire field has been divided into as many as 1000 equivalent headings (families).

The U. D. C. is derived from the system designed by Dewey in 1873. The main classification comprises the following subjects:

0. Generalities, bibliography, library science.
1. Philosophy, ethics, psychology.
2. Religion, theology.
3. Social sciences, law, government.
4. Philology.
5. Pure sciences.
6. Applied sciences, medical science, technology.
7. Art, play, sports.
8. Literature.
9. Geography, history, biography.

Since the founding of the "Institut International de Bibliographie" in 1895 five editions of the code have appeared. The third (German) edition of 1933 is the most extensive at the moment (0—5 and 62—66).

The fourth (English) edition of 1936 comprises only a few chapters from the pure sciences.

The fifth (French) edition of 1939 comprises 0, 2, 3, 61 and 65.

A number of abridged editions have appeared, inter alia, in Dutch, Swedish, Rumanian, Italian, Czech, Russian and Polish.

The extension and revision of the U. D. C. is organized by an International Committee for Universal Decimal Classification, who has now enlarged the code to include more than 90,000 headings.

The U. D. C. has so far found its widest application in literature and management documentation. The system is being used, inter alia, by the Science Library (London). Engineering Societies Library (New York) and the (still existing?) Verein deutscher Ingenieure.

B. Application in the Hollerith identification scheme.

The classification of wood species, use of which is made in characteristics group 1 of the Hollerith card, has been designed by van Heurn (1944) in collaboration with the present writer (1943). The proposals are included in the issue of the U. D. C. now in course of preparation.

A survey of wood species might be given under three headings of the U. D. C., viz. Taxonomy (582); Forestry (634.9) and Wood Industry (674).

So-called auxiliary figures make it possible to use one and the same classification of wood species in the three chapters mentioned.

These auxiliary figures are indicated by the symbol .0.

All hardwoods start with the figure combination .031, all softwoods with .032. In this way 674.031 means hardwoods in connection with timber industry and 634.9.031 hardwoods from the forestry point of view.

The system of Engler and Prantl down through the subfamilies has been followed in the classification of softwoods and hardwoods. Three to five figures are necessary to indicate their order, family and subfamily.

The sequence of genuses has been so chosen, that technically important timbers come first.

In practice most wood species are indicated by the name of the genus, in addition to which the country of origin is given.

In order to incorporate the latter commercially important feature, the distribution area has been added to the generic numbers. The figures chosen for this purpose are in accordance with those applied by the U. D. C. for indicating geographical regions. Thus 4 means Europe and the Mediterranean area, 5 East Asia, 6 Africa, 7 America (as a whole) and 9 Australia. These figures are stated only if the genus indicated occurs in more than one of the regions just mentioned.

Finally a division of species in each group is given.

Twelve to fifteen figures are necessary to indicate a wood species in the Universal Decimal Classification. The first six of them can be omitted when using Hollerith cards as they only mean "softwood" or "hardwood".

For this reason nine columns have been reserved as a maximum for stating botanical features. The method of codification mentioned makes it possible to select cards according to order, family, genus and species, which is very important in connection with studies on the distribution of characteristics in botanical units.

Geographical regions indicated in feature group 2 are given as auxiliary tables in the U. D. C. The continents are subdivided here and special subjects such as rivers and mountains are included.

This group enables a selection of cards, representing wood species from any continent or country desired.

V. SUMMARY.

The International Association of Wood Anatomists in the early years of its existence has undertaken to standardize the nomenclature used in describing woods. Later the classes of dimensions have been added thereinto.

In the same way it should be possible now to standardize one or two identification methods.

Universal schemes in the first place will fit for this purpose. In the introduction it is explained which requirements should be fulfilled in such schemes.

The advantages and drawbacks of an English and a Dutch identification method are compared mutually. It is suggested, that a procedure according to the Hollerith system will allow of a synthesis of both methods mentioned, thus combining advantages and eliminating their drawbacks. The restriction in the applicability of the Hollerith scheme is determined by the fact, that complicated devices are necessary the costs of which can only be justified, if they are constantly employed at full capacity. Thus the method can only be used in a central office.

It will especially yield good results if a close international collaboration is established.

A standardized codification and centralized multiplication and distribution of cards are indispensable requirements for realising this purpose.

A short general survey is given of the Universal Decimal Classification and it is explained according to which principles wood species have been included in this scheme. The decimal codes of the U. D. C. can be used for indicating botanical and geographical data in the Hollerith identification.

In this way, the great advantage is achieved, that a literature card index on wood species can be compiled with the same figure combinations. In doing so these figures get a wider field of application than when independant classifications are made for identification and documentation purposes.

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MISCELLANEOUS BOTANICAL NOTES II [1]

by

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(Issued 1. VI. 1948).

18. ADDITIONAL NOTE ON MALAYSIAN LONICERA (Caprifoliaceae).

The privilege of being able to examine numerous sheets of *Lonicera* in the U. S. Nat. Herbarium Washington, Jan. 1947, some in the Kew Herbarium, Nov. 1946, and some in the Leyden Herbarium, Oct. 1946, enabled me to make some further observations which clarify the status and distribution of the Malaysian species, which I preliminarily treated in the Journ. Arnold Arbor. 27 (1946) 442—452, a little further.

1. **Lonicera repens** Zipp. ex Miq., Fl. Ind. Bat. 2: 128. 1856; cf. J. Arn. Arb. 27 (1946) 451, was referred by Miquel to *L. chinensis*, and belongs, according to Ind. Kew and Dr Rehder's paper to *L. japonica* Thunb. In the Leyden Herbarium there are 3 authentic sheets; of one the label reads "New Guinea", of an other "? Java" and of the third "? Java. ? New Guinea". All belong doubtless to *L. japonica* Thunb. and in my opinion this is a clear case of mislabelled specimens which came from Java, probably from specimens cultivated in the Botanic Gardens at Buitenzorg.

2. **Lonicera malayana** Henderson, in Journ. Fed. Mal. States Mus. 11 (1924) 187, I referred with doubt to *L. pulcherrima* Ridl. in Journ. Arn. Arbor. 27 (1946) 449. It is certainly a species distinct from all other Malaysian ones and represents the 5th indigenous species of Malaysia. It can easily be distinguished by the following characters: stems, stalks, petioles, leaf margins with long spreading hairs; inflorescences lateral, 1½—3 cm peduncled, 2-flowered; corolla hairy, 8—9 cm long incl. a tube 4—6 cm long; style glabrous far protruding; leafmargin flat fimbriate through long hairs; parenchyma not bullate, not tomentose on the undersurface; leaftip short-acuminate.

L. malayana is probably nearest related to *L. affinis* Hook. & Arn. from China & Japan. It occurs certainly outside the Malay Peninsula, as a sheet from Hainan (*F. C. How & N. K. Chun 70187*) identified as

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[1]) Misc. Bot. Notes I will be published in the Bull. Jard. Bot. de Buitenzorg.

L. macrantha Spreng. seems identical; it ought also to be compared with *L. similis* Hemsl. from China.

3. **Lonicera acuminata** Wall. in Roxb., Fl. Ind. ed. Carey 2: 176 (1832). The distribution and synonymy of the species I cited in Journ. Arn. Arb. 27 (1946) 445, viz India, Sumatra, Java, Bali and the Philippines indicated that its occurrence in Formosa and China was highly probable. This conclusion proved right, and I found some species recorded from these regions described under various names which must be merged into *L. acuminata.* They are the following:

Lonicera henryi Hemsl., in J. Linn. Soc. 23 (1888) 359 from China,

Lonicera transarisanensis Hayata, Ic. Pl. Formos. 6 (1916) 25 from Formosa,

Lonicera vestita W. W. Sm., Not. Roy. Bot. Gard. Edinb. 10: 49, 1917, from Yunnan, whereas the type of

Lonicera giraldi Rehd., in Rep. Missouri Bot. Gard. from China exactly matched *L. acuminata* as I supposed l. c.

The distribution of *L. acuminata* is thus a closed continuous area in S.E. Asia.

4. **Lonicera pulcherrima** Ridl., in J. As. Soc. Mal. Br. 1 (1923) 64; cf. Journ. Arn. Arbor. 27 (1946) 449, is hitherto only known from Sumatra, but occurs certainly also in S.E. Asia. A sheet from China (Kiangsi *Lau 4649*) is an exact match. It is very closely allied if not identical with *L. leschenaultii* Wall. from the Deccan Peninsula and ought to be compared with *L. reticulata* Champ. (non Rafin.) from China.

19. GYMNOTHECA DECNE, A GOOD GENUS OF THE SAURURACEAE.

In 1845 J. Decaisne [1] described the genus *Gymnotheca* from China. An excellent figure accompanied the description of the genus which was based on a single species *G. chinensis* Decne. This genus was later merged into *Houttuynia* by Bentham & Hooker in their Genera Plantarum [2], but reinstated by D. Oliver [3]. Engler [4], in 1889, erroneously reduced it without further comment to *Houttuynia cordata* Thunb.

Merrill [5] referred it as a distinct species to the genus *Saururus* under the name *S. cavaleriei* Lév. [6], as the epithet *chinensis* is preoccupied in the genus *Saururus.* He states its undoubted identity with Léveillé's species in spite of latter's short and imperfect description. Merrill's record is from Indo-China. According to Groff [7] Handel-Mazzetti shares Merrill's opinion in assigning *Gymnotheca* to *Saururus, but* H.-M.'s publication is unfortunately not available to me.

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[1] Ann. Sc. Nat. III, 3 (1945) 102, t. 5.
[2] Genera Plantarum 3 (1880) 128.
[3] Hook. Icon. plant. 19 (1889) pl. 1873.
[4] Pflanzenfamilien 3^1 (1889) 3.
[5] Univ. Calif. Publ. Bot. 13 (1926) 128.
[6] In Fedde, Repert, 10 (1911) 149.
[7] Lingnan Science Journal 11 (1932) 85.

In reviewing the Malaysian Saururaceae I have come to the conclusion that *Gymnotheca* is a good genus and I base by opinion on the characters mentioned in the key below. Of *Gymnotheca* I could study one specimen *Pételot 6298* from Tonkin, recently presented by the Arnold Arboretum to Buitenzorg.

The habit of *Gymnotheca chinensis* Decne. is quite different from any of the other Saururaceae, and *Saururus* species described; it approaches that of the Piperacea *Zippelia begonifolia*. The herbarium material I studied was much pressed and did not much improve by boiling; to this I ascribe that I only found 2 placentas. The flowers of the *Pételot 6298* specimen agree exactly with Oliver's plate[1]) and are somewhat different from Decaisne's drawing, as the anthers are ± equal in length to the filaments and the styles are much exceeding the anthers in length. In Decaisne's drawing the styles are very short. I cannot decide whether there are different sexual forms of one species, or that these organs are liable to a great variability. There may be 2 races. The difference can hardly be due to the age of the flowers. Though the lowest bracts of *Pételot 6298* have a tendency to become larger and whitish (to consider from herbarium material) there is no question that they are petaloid.

The differences between the genera of the *Saururaceae* can be summarized as follows in a

Key to the Genera.

1. Fruit consisting of 4-connate but separating tubercled carpels. Cocci indehiscent, 1-seeded. 2 species . . . . **Saururus**

1a. Ovary 1-locular. Capsule dehiscent at the apex.

  2. Placentas 3(—4). Styles 3(—4). Spiker subtended by a petaloid involucre.

    3. Leaves cauline, palminervous. Intrapetiolar stipule ± free. Stamens 3, adnate to the base of the ovary. Ovary not sunk into the rhachis of the spike. Plant glabrous. Involucral bracts 4. Monotypic . . . . . **Houttuynia**

    3a. Leaves mostly radical, one on the scape, penninervous. Stipules proper absent, petiole sheathing. Stamens 6—8, epigyn. Ovary sunk into the rhachis of the spike. Fruit coalescent with the spadix. Plant hairy. Involucral bracts 6 (5—8). Monotypic . . . . **Anemopsis** [2])

  2a. Placentas 4. Styles 4. Racemes without petaloid involucre. Stamens 6, epigyn. Ovary stipitate. Watery herb, with habit of Zippelia. Bract free from pedicel. Stem winged, in the dried state at least, not ribbed. Petiole sheathing. Monotypic . . . . **Gymnotheca**

20. RECORDS OF SOME MALAYSIAN COMPOSITAE.

During a short stay in England, Nov. 1946, I could study some sheets of Malaysian Composites which are worthy of mention.

1. Carpesium cernuum L. was cited from Java in Hook. f. Fl. Br. Ind. 3 (1882) 300, on account of a specimen collected by *T. Anderson no. 336*. As Anderson collected only in West Java, and *Carpesium* occurs in Java only in the eastern part (very rarely) a re-examination seemed necessary. The sheet proved to represent a glabrate form of *Centratherum frutescens* B. & H. collected on Mt Malabar.

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[1]) Hook. Icon. plant. 19 (1889) pl. 1873.

[2]) By Lemée, Dict. Descr. 3 (1931) 655 merged into *Houttuynia*.

2. **Rhynchospermum verticillatum** Reinw. Borneo. Br. Borneo, Mt. Kinabalu, Masilau, jungle margin, fls dull white, 2400 m alt., *M. S. Clemens 51054.* This is an interesting record as the species is extremely rare in Malaysia and only very locally known from the mountains of West Java. The number was provisionally distributed as *Carpesium* sp.

3. **Gerbera piloselloides** (L.) Cass. (*G. peregrina* Steen., Bull. Jard. Bot. Btzg sér. III, 14 (1936) 61, *n. syn.*).

A renewed comparison of the specimens from Bali Island with Asiatic and African ones showed that the Malaysian specimens must be reduced to this widely distributed species, recorded from various parts of Africa and S.E. Asia. The neck of the achene lengthens considerably towards ripening.

21. REPORT ON SOME USEFUL PLANTS FROM THE ISLAND OF ALOR (TIMOR ARCHIPELAGO, N. E. I.) COLLECTED BY MISS CORA DU BOIS IN 1939.

The material at hand was collected by Miss Cora du Bois at the end of January 1939 in the mountainous inland of Alor island, N. of Timor, Netherlands East Indies, near the village of Atimelang at ca. 750 m altitude. It was donated to the Buitenzorg Herbarium; data are cited from the labels of Miss du Bois.

In all 99 numbers were collected, most of which could be identified. Of some the material was insufficient, e.g. in bamboos which require a special collecting knowledge. It is assumed that for food products the collection is fairly complete and representative.

Several useful plants are represented in numerous strains or varieties, bamboo, banana, maize, manioc, yams, rice, mango, sweet potatoes, taro &c. Without further extensive botanical study on the spot these can hardly be named safely as to their subspecific or racial name. Some of these varieties have been introduced recently, others have been in cultivation since old time. It is impossible to present a survey of the sequence of their import in Alor in general, and the village Atimelang in particular.

However, some general remarks can be made. In the first place it is clear that the principal food of the people of Atimelang more closely approaches the diet of the Indonesian before the New World was opened for international trade. Long before that date — say some two to three thousands years ago — the Indonesian diet was probably a still poorer one, due to the remarkable and amazing poorness of the Malaysian region in native or subnative principal vegetable staple foods which come to sago, yams, taro, sugarcane, coconut, millets, sugarpalm, breadfruit, some leguminous and cucurbitaceous plants, fruits, vegetables, bananas, bamboo sprouts, pandans, and fat containing seeds. The primitive diet in Malaysia did not permit the development of a dense population. This occurred only through the assimilation of exotic food plants, and mostly in post-Columbian time. Several primitive food plants are now out of use, or only used in periods of famine.

Rice is apparently scarce, and is in Atimelang primarily used as a feast food. It is apparently also mostly planted on non-inundated soil, its growth depending on and succeeding only through a sufficient amount of water in the dry season. This remains always a hazardous experiment for the native farmer. No mention is made by Miss Du Bois of rice planted on irrigated paddy fields. This requires highly experienced farmers, and moreover, favourable circumstances, viz. enough water through the greater part of the year, a fertile soil, smooth sloping topography and farmers who are skilled and able to planning.

It is still an undecided question whether rice (*Oryza sativa* L.) is really indigenous in Malaysia. Judging from some thousands of photographs of the "bas-reliefs" from Borobudur in Central Java on which only primitive millets are represented, rice was absent in Java at that rather recent date. No positive, deciding arguments for the presence of rice are offered from other sources[1].

The enumeration of the plants represented in the collection of Miss du Bois I have arranged in Pteridophytes and Phanerogams, and the latter are enumerated in the families in an alphabetical order.

Taking the collected bamboos as one entity 61 species are represented in all. They can be grouped according to their possible origin as follows:

A. Native in Malaysia, and probably in Alor:

Adiantum philippense L.
Drynaria sparsisora Moore
Ichnocarpus frutescens Ait.
Gossampinus heptaphylla Bakh.
Canarium commune L.
Cycas rumphii Miq.
Dioscorea pentaphylla L.
Aleurites moluccana M. A.
Phyllanthus emblica L.
Caesalpinia sappan L.
Dolichos falcatus Klein
Phaseolus scaberulus Miq.
Hiptage benghalensis Kurz.
Antiaris toxicaria Lesch.
Ficus ampelas Burm.
Ficus callosa Willd.
Ficus infectoria Roxb.
Ficus sp.
Arenga pinnata Merr.
Piper betle L.

B. Old cultigens of the palaeotropics of which the origin cannot be traced or fixed to a certain limited country:

Mangifera indica L.
Mangifera odorata L.
Colocasia esculenta Schott
Ipomoea alba L.
Dioscorea alata L.
Dioscorea esculenta Burk.
Bambusa sp.
Canavalia gladiata DC.
Pueraria triloba Backer
Vigna sinensis Savi
Artocarpus incisus L. f.
Artocarpus integra Merr.
Musa paradisiaca L.
Areca catechu L.
Citrus aurantifolia Swingle
Citrus hystrix DC.
Solanum melongena L.
Melochia umbellata Stapf
Centella asiatica Urban

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[1] Cf. also D. Chatterjee, Botany of the wild and cultivated rices, in Nature 160, 1947, 234.

C. A. Backer in Blumea Suppl. III, 1946, 45 on the five wild *Oryza*-species in Malaysia.

C. Cultivated plants with a probable African origin:

Citrullus vulgaris L.
Cucumis sativus L.
Lagenaria leucantha Rusby
Tamarindus indica L.

D. Cultigens certainly not native in Malaysia and probably derived from the Asiatic flora.

Oryza sativa L.
Moringa oleifera L.
Kaempferia galanga L.

E. Plants from the New World, most probably introduced in post-Columbian time.

Amaranthus spinosus L.
Ananas comosus L.
Carica papaya L.
Ageratum conyzoides L.
Ipomoea batatas L.
Cucurbita moschata Duch.
Euphorbia hirta L.
Jatropha curcas L.
Manihot esculenta Crantz
Zea mais L.
Phaseolus lunatus L.
Capsicum annuum L.
Nicotiana tabacum L.

From this table it appears once more, that the majority of the more important food plants have been derived from the New World flora. Malaysia with its favourable climate and soil conditions, but poor in native food stuffs has eagerly absorbed the new sources for living. The great increase in population in the last centuries is for a great deal due to outside factors which were turned to its benefit, by the potentialities of human adaptability, willingness and ableness for agricultural work, together with the favourable factors nature offered here in fertile soils and reasonably good climates for prospering crops.

At Atimelang the Alorese possess — if the collection is representative — rather few vegetables, and medicinal plants, and there are surprisingly few plants with magical use: a fern (*Drynaria sparsisora*) and a cotton tree (*Gossampinus heptaphylla*) are mentioned to possess an effective curse against *Areca*-thieves, and *Kaempferia galanga* is also used magically. Plants having properties due to the signature or transmigration hypothesis are not mentioned.

Miss Du Bois's collection represents one of the very few botanical contributions to these remote parts of the Lesser Sunda Islands, and though it is specially centering round useful plants it adds to our knowledge. I tender her my heartiest thanks for entrusting me with the identification.

Botanic Gardens Buitenzorg, 1939/The Hague, 1947.

Polypodiaceae.

1. **Adiantum philippense** L.

Hab.: Alor; Atimelang, 750 m alt., *No. C.* Vern. n.: *kamoe-kamoer.*

Annotations: A native maiden-hair fern, widely distributed, specially in dry regions, also cultivated.

2. Drynaria sparsisora Moore.

Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 47.* Vern. n.: *tameti.*

Use: Roots are used as *Areca* substitute. Leaves used magically as theft curse. Placed on bamboo pole near *Areca* trees. Thief supposed to be afflicted with insanity if he disregards the curse.

Annotations: Widely distributed epiphytic fern with dimorphic leaves, mostly occurring at low altitudes and in the hills, specially in secondary forests, and on isolated trees in settlements, sometimes on rocks, closely allied to *Dr. quercifolia.* Indigenous.

Amaranthaceae.

3. Amaranthus spinosus L.

Hab.: Alor, Atimelang, 750 m alt., very plentiful, not planted, *No. 18.* Vern. n.: *boeloengai.*

Use: leaves are boiled with maize or beans.

Annotations: A spiny weed, native or tropical America, now spread throughout the tropics, in Malaysia it is often collected for use as spinach.

Anacardiaceae.

4. Mangifera indica L.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted or volunteer, *No. 14.* Vern. n.: *dodo maja.*

Use: fruit eaten raw before fully ripe.

b. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted and volunteer, *No. 58.* Vern. n.: *molopai.*

Use: Fruit eaten raw, usually before fully ripe.

c. Hab.: Alor, Atimelang, 750 m alt., plentiful, both volunteer and planted, *No. 59.* Vern. n.: *manpalela.*

Use: Fruit eaten raw, usually before fully ripe.

d. Hab.: Alor, Atimelang, 750 m alt., plentiful, both planted and volunteer, *No. 68.* Vern. n.: *maja malieng.*

Use: Fruit eaten raw, but considered very sour.

Annotations: A fruit tree native in India and already cultivated in Malaysia in remote time. It grows best in regions where the climate has strongly marked seasons. Many varieties exist.

5. Mangifera odorata Griff.

Hab.: Alor, Atimelang, 750 m alt., plentiful, planted and volunteer, *No. 60.* Vern. n.: *majakang.*

Use: Fruit eaten raw, usually before fully ripe.

Annotations: A large tree, native in S.E. Asia, cultivated throughout the whole of Malaysia. The fruits are always claimed to be inedible when unripe.

Apocynaceae.

6. **? Ichnocarpus frutescens** Ait.
Hab.: Alor, Atimelang, 750 m alt., not planted, plentiful at some distance from the villages, *No. 62.* Vern. n.: *amoelai.*

Use: Bark used to make a fine thread for wrapping arrow shafts, etc.

Annotations: The material is sterile and the identification remains therefore somewhat doubtful. Distribution from Asia to Australia; use as indicated known elsewhere in Malaysia.

Araceae.

7. **Colocasia esculentum** Schott.
Synonyms: *C. antiquorum* Schott.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, volunteers, not deliberately planted, *No. 6.* Vern. n.: *karij.*
Use: Tubers are boiled and eaten.

b. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 5.* Vern. n.: *Aho.*
Use: Young shoots and tubers are boiled and eaten. Said to be used less now than formerly.

Annotations: Tuberous crop of ancient cultivation, possibly a native of India and from there spread in cultivation. Numerous races are known.

Bombacaceae.

8. **Gossampinus heptaphylla** (Houtt.) Bakh.
Synonyms: *Bombax malabaricum* DC.
Hab.: Alor, Atimelang, 750 m alt., rare, not planted, *No. 73.* Vern. n.: *boij.*

Use: Fruit used magically, effective curse against theft of *Areca.*

Annotations: The material is sterile and the colour of the flowers unnoticed. However, the only species hitherto known from the Lesser Sunda Islands is this one, *G. valetonii* (Hochr.) Bakh., being only recorded from Burma, the Mal. Peninsula, Sumatra and Java.

Bromeliaceae.

9. **Ananas comosus** (L.) Merr.
Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 44.* Vern. n.: *toenwati.*

Use: Fruit eaten raw.

Annotations: The common nanas or ananas in tropical America, where it was cultivated from very remote times. After the discovery of America it was taken all round the world by the Portuguese and Spaniards. Numerous varieties are cultivated in Malaysia.

Burseraceae.

10. Canarium commune L.

Hab.: Alor, Atimelang, 750 m alt., rare, only 5—6 trees in the valley, planted, *No. 43.* Vern. n.: *kanai.*

Use: Nut eaten raw, boiled with "oebi kajoe"; mashed raw with lombok and used as relish.

Annotations: The Kenari-nut or Java almond tree, indigenous only in Celebes, the Lesser Sunda Islands and the Moluccas, since an early date grown elsewhere; the seeds are delicious.

Caricaceae.

11. Carica papaya L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 9.* Vern. n.: *bata mija.*

Use: Leaves are boiled and mixed with maize. Fruit is eaten raw or boiled. Natives recognize male and female trees.

Annotations: Papaya came originally form America, and is since Columbian times cultivated throughout the tropics.

Compositae.

12. Ageratum conyzoides L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 77.* Vern. n.: *soema hamoeni.*

Use: Leaves scorched over fire and laid on fresh wounds; sometimes mashed, mixed with lime and laid on fresh wounds.

Annotations: Annual weed, pantropic. Medicinal use also elsewhere known in Malaysia.

Convolvulaceae.

13. Ipomoea alba L.

Synonyms: *Calonyction bona-nox* Boj.

Hab.: Alor, Atimelang, 750 m alt., *No. B.* Vern. n.: *téjla.*

Annotations: Widely distributed in the palaeotropics, both wild and cultivated.

14. Ipomoea batatas L.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 75.* Vern. n.: *serang balej.*

Use: leaves boiled as vegetable, tubers roasted or boiled.

Annotations: This is the form with incised leaves.

b. Hab.: Alor, Atimelang, 750 m alt., planted and volunteer, *No. 90.* Vern. n.: *bale koeli* (koel = white).

Use: Tubers roasted or boiled. Leaves boiled with maize.

Annotations: This is the form with simple leaves.

c. Hab.: Alor, Atimelang, 750 m alt., planted and volunteer, *No. 91.* Vern. n.: *bale kika* (kika = red).

Use: Tubers roasted or boiled, leaves boiled with maize.

Annotations: This is the form with simple leaves. *Ipomoea batatas* is probably introduced from America, but is cultivated in Malaysia for centuries. It occurs from the plains up to the mountains in fields and is sometimes seemingly wild in abandoned fields.

Cucurbitaceae.

15. **Citrullus vulgaris** L.

Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 7.* Vern. n.: *arang ki'.*

Use: Fruit eaten raw.

Annotations: A climbing herb of possibly African origin cultivated in Egypt in very remote times, known in several races.

16. **Cucumis sativus** L.

Hab.: Alor, Atimelang, 750 m alt., planted, plentiful, *No. 67.* Vern. n.: *ki' rama.*

Use: Fruit eaten raw or boiled.

Annotations: Coarse, several years living, prostrate or twining, cultivated herb, sometimes locally run wild, probably a native from Africa.

17. **Cucurbita moschata** Duchesne.

Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 8.* Vern. n.: *adeti.*

Use: Leaves boiled and mixed with maize. Fruit boiled or roasted.

Annotations: Annual creeping or prostrate, coarse plant, often cultivated and sometimes seemingly wild. An American cultigen, distributed now widely throughout the world.

18. **Lagenaria leucantha** Rusby.

Synonyms: *L. vulgaris* Ser.

Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 92.* Vern. n.: *tenga.*

Use: Gourd, dried, cut in half, and scraped out, used as plate.

Annotations: Probably native in Africa, since centuries cultivated throughout the tropics.

Cycadaceae.

19. **Cycas rumphii** Miq.

Hab.: Alor, Atimelang, 750 m alt., rare, not planted, *No. 74.* Vern. n.: *la.*

Use: Fruit soaked, then boiled and eaten, either alone or mixed with corn.

Annotations: This is an extraordinary high altitude for this species. Several varieties of this polymorphic species are distinguished but the treatment by Schuster is not convincing. It is typical for coasts but also in Java it is found inland up to some hundreds of metres scattered in forests.

Dioscoreaceae.

20. Dioscorea alata L.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 15.* Vern. n.: *fotake* (fobake?).

Use: Tubers boiled and eaten.

b. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 17.* Vern. n.: *fala ko* (=house tuber).

Use: Tubers are roasted or boiled.

c. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 20.* Vern. n.: *amakang ko* (= person tuber).

Use: Tubers roasted or boiled and eaten.

d. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 22.* Vern. n.: *ko kika* (= tuber red).

Use: Tubers eaten roasted or boiled.

e. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 23.* Vern. n.: *il ko.*

Use: Tubers eaten roasted or boiled.

f. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 30.* Vern. n.: *mon ko* (snake tuber).

Use: Tuber boiled.

g. Hab.: Alor, Atimelang, 750 m alt., planted, *No. 40.* Vern. n.: *ko baka.*

Use: Tuber is boiled and eaten.

h. Hab.: Alor, Atimelang, 750 m alt., planted, plentiful, *No. 54.* Vern. n.: *kafola ko* (ko = tuber).

Use: Tuber roasted or boiled, eaten.

i. Hab.: Alor, Atimelang, 750 m alt., planted, plentiful, *No. 76.* Vern. n.: *pelang ko* (= boat tuber).

Use: Tubers boiled or roasted.

j. Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 83.* Vern. n.: *oeten.*

Use: Tuber boiled, not roasted.

Annotations: According to Burkill the Greater Yam is a cultigen and does not occur in the wild state. The origin was in S.E. Asia. It is now widely distributed. Numerous strains, all propagated vegetatively are distinguished.

21. Dioscorea esculenta (Lour.) Burkill.

Synonyms: *D. aculeata* auct. non L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 21.* Vern. n.: *da'.*

Use: Roots eaten boiled or roasted.

Annotations: A prickly climber, apparently native in Indo-China, and undoubtedly of ancient cultivation throughout the East.

22. Dioscorea pentaphylla L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, both wild and planted, *No. 49.* Vern. n.: *koei.*

Use: Roots boiled or roasted, eaten.

Annotations: Widespread yam, throughout the moist parts of India and Malaysia to the remotest islands of the Pacific.

Euphorbiaceae.

23. Aleurites moluccana M. A.

Hab.: Alor, Atimelang, 750 m alt., planted and volunteer, *No. 13.* Vern. n.: *fi ai.*

Use: Used to polish rattan belts and headgear with oil of nuts. Sold on coast to the Chinese.

Annotations: The candle nut or Indian walnut is native in Malaysia but now widely cultivated throughout the tropics, the drying oil is in Java and Celebes used for candles and also used in food.

24. Euphorbia hirta L.

Hab.: Alor, Atimelang, 750 m alt., plentiful weed, not planted, *No. 48.* Vern. n.: *tek hatang* (lizard, its hand).

Use: Juice of stalked mixed with powdered coconut húsk charcoal to make paste for tatooing pigment. Leaves chewed by women as contraceptive.

Annotations: Pantropic weed, certainly not indigenous in Malaysia.

25. Jatropha curcas L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 4.* Vern. n.: *arang jiai.*

Use: Oil of nuts used as torch (infrequently) and used as bait in rat traps.

Annotations: Certainly introduced in the Old World. In dry regions it often runs wild, and was e.g. very conspicuous in the revegetation of Mt Tambora ashes in the island of Soembawa.

26. Manihot esculenta Crantz.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 1.* Vern. n.: *batako hong koeli* (hong koeli = on top white).

Use: leaves boiled and eaten as vegetable. Tubers eaten raw or boiled, dried for preservation.

b. Hab.: Alor, Atimelang, 750 m alt., plentifully, planted, *No. 2.* Vern. n.: *batako hong kika* (hong kika = on top red).

Use: Leaves boiled and eaten as vegetable. Tubers boiled, also dried for preservation.

Annotations: This is a variety of No. 1, distinguished by red leaves at the end of the twigs.

c. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 3.* Vern. n.: *batako boekoe liking.*

Use: Tubers roasted or boiled, leaves boiled as vegetable.

d. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 11.* Vern. n.: *batako kang* (kang = good).

Use: Leaves *not* eaten. Tubers eaten raw or boiled, not bitter. If bitter they are dried before eating.

Annotations: The cassava or manioc is a plant of American origin, and is now since Columbian time commonly cultivated throughout the tropics. There are many varieties and forms.

27. Phyllanthus emblica L.

Synonyms: *Emblica officinalis* Gaertn.

Hab.: Alor, Atimelang, 750 m alt., rare, not planted, *No. 52.* Vern. n.: *kadamai.*

Use: Fruit boiled, mashed and mixed with a special earth to blacken teeth at adolescence.

Annotations: Small or moderate tree known from S.E. Asia through Malaysia, apparently native in both countries, also cultivated.

Gramineae.

28. Bambusa sp.?

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 35.* Vern. n.: *peting.*

Use: Used for water tubes, bows and arrows; fire saw; rat or cat traps; bamboo-zither; combs. Young shoots not eaten, but sold on coast to garrison.

b. Hab.: Alor, Atimelang, 750 m alt., plentiful, but at some distance from village, not planted, *No. 36.* Vern. n.: *toea.*

Use: Used for decorative motifs in weaving baskets, for houses; benches; house ladders; for combs.

Annotations: The material is sterile and insufficient for specific as well as generic identification.

c. Hab.: Alor, Atimelang, 750 m alt., plentiful, but far from villages, not planted, *No. 37.* Vern. n.: *kela.*

Use: Used for baskets, house building; fish traps; drinking tube when teeth are blackened; flute; fire tube.

Annotation: The material is sterile and not adequate for identification.

d. Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 38.* Vern. *n.: tifot.*

Use: Used for tobacco tubes, for corn- and bean container; for sacred hearth paraphernalia; fire tube.

Annotation: The material is insufficient for further identification.

e. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, is most common, *No. 39.* Vern. n.: *mai.*

Use: For weaving baskets, house building, for bows and arrows, house ladders, fire saw, mouse traps or cat traps, bamboo zither, fire tube.

Annotations: The material is insufficient for further identification.

29. Oryza sativa L.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, dry planting, *No. 63.* *Vern. n.: Pining is or mooe baka ajak* (ajak = rice).

Use: Primarily feast food.

b. Hab.: Alor, Atimelang, 750 m alt., dry planting, plentiful, *No. 64.* Vern. n.: *tebang ajak* (ajak = rice).

Use: Primarily feast food.

c. Hab.: Alor, Atimelang, 750 m alt., dry planting, plentiful, *No. 65.* Vern. n.: *kaka ajak* (crow rice).

Use: Primarily feast food.

d. Hab.: Alor, Atimelang, 750 m alt., dry planting, *No. 66.* Vern. n.: *mai malieja ajak* (ajak = rice).

Use: Primarily feast food.

e. Hab.: Alor, Atimelang, 750 m alt., dry planting, plentiful, *No. 69.* Vern. n.: *falekasing ajak.*

Use: Primarily feast food.

f. Hab.: Alor, Atimelang, 750 m alt., dry planting, plentiful, *No. 70.* Vern. n.: *takang paliking or malama.*

Use: Primarily feast food.

Annotations: Rice is a cultigen from remote time in S.E. Asia. Nearly a 1000 varieties are known in Malaysia. In the mountains of the eastern Lesser Sunda Islands and several places in Celebes well-watered paddy fields cannot be laid; there rice is scarce and is replaced by other crops as a staple food.

30. Zea mais L.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 26.* Vern. n.: *fati kika* (= maize red).

Use: Roasted, boiled or parched.

b. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 27.* Vern. n.: *koepang fati* (foreign maize).

Use: Roasted, boiled or parched.

Annotations: This strain was imported ca 10 years ago.

c. Hab.: Alor, Altimelang, 750 m alt., plentiful, planted, *No. 28.* Vern. n.: *fati ramá* (maize early).

Use: Roasted, boiled, parched.

d. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 29.* Vern. n.: *fati koeli* (= maize white).

Use: Roasted, boiled, parched.

e. Hab.: Alor, Atimelang, 750 m alt., planted, plentiful, *No. 55.* Vern. n.: *kaij fati* (fati = maize).

Use: Roasted, boiled, parched.

Annotations: A cultigen of undoubted American origin, in the regions of Malaysia characterized with a dry climate now the most important staple food (E. Java, The Lesser Sunda Islands, Celebes). In recent years numerous varieties have been imported and distributed among the native population.

Leguminosae.

31. **Caesalpinia sappan** L.

Hab.: Alor, Atimelang, 750 m alt., rare, not planted as rule, sometimes planted on village boundary, *No. 81.*

Use: Wood used for large strong bows.

Annotations: A small prickly tree found from India throughout Malaysia, also planted. Since Hindu times sappan wood was one of the valuable forest products; the wood from the Lesser Sunda Islands was highly estimated. Large sizes are now rare.

32. **Canavalia cf. gladiata** DC.

Hab.: Alor, Atimelang, 750 m alt., rare, wild, also planted, *No. 53.* Vern. n.: *kadia.*

Use: Fruit soaked, 24 hours boiled, eaten alone or mixed with maize.

Annotations: Cultivated in Java up to ca. 1200 m by natives, possibly a ultivated form of *C. virosa* W. & A. The material is sterile but the left-twining stem points to *C. gladiata.* The native country and origin of the plant are uncertain, perhaps derived from *C. virosa,* found in cultivation throughout the East.

33. **? Dolichos falcatus** Klein.

Hab.: Alor, Atimelang, 750 m alt., rarely planted, *No. 12.* Vern. n.: *al bilia.*

Use: Fruit shelled, boiled, eaten.

Annotations: Identification in absence of flowers not absolutely safe. Perennial, tuberous, native in India and Malaysia.

34. **Phaseolus lunatus** L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, both wild and planted, *No. 86.* Vern. n.: *tadá.*

Use: Leaves boiled as vegetable. Beans leached over night and boiled. If not leached beans said to act as an emetic.

Annotations: The lima bean is a climber of American origin brought into cultivation by the Spanish and is now spread throughout the tropics. Several varieties are known some of which contain prussic acid, for the removal of which special treatment is necessary.

35. **Phaseolus ? scaberulus** Miq.

Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 57.* Vern. n.: *laboeta.*

Use: Inner bark used for bow string.

Annotations: The material is sterile. The juvenile stem sprouts from a tuber and is very slender.

36. **Pueraria triloba** (Lour.) Backer.

Synonyms: *Pachyrrhizus trilobus* DC.

Hab.: Alor, Atimelang, 750 m alt., plentiful, planted as well as wild, *No. 19.* Vern. n.: *bike.*

Use: Tubers boiled and eaten. Bark used for cord for women's belt.

Annotations: Coarse climber, with tuberous roots, cultivated both in S.E. and E. Asia and Malaysia since a very long time.

37. Tamarindus indica L.

Hab.: Alor, Atimelang, 750 m alt., rare in valley, not planted, *No. 45.* Vern. n.: *tamali.*

Use: bean eaten raw or boiled with meat. Also crushed raw and mixed with lime or ashes, and used as relish.

Annotations: Burkill accepts this as native both in certain parts of Africa and India as well as cultivated. In Malaysia it is often cultivated or used as a roadside tree. It is wild in some places in the Lesser Sunda Islands and I have photographs of rather pure forests where the tree propagates itself. It prefers a two season climate.

38. Vigna sinensis (L.) Savi.

Synonyms: *Vigna catjang* Wall.

Hab.: Alor, Atimelang, 750 m alt., very plentiful, planted, *No. 46.* Vern. n.: *takoij.*

Use: Boiled and eaten alone or mixed with rice or maize. Children (not adults) may roast in pod. Shelled and stored dry in bamboo tubes.

Annotations: A plant of such ancient cultivation that its country of origin is uncertain, but is was either Asiatic or African; in Malaysia probably repeatedly introduced by the Chinese (Burkill).

Malpighiaceae.

39. Hiptage benghalensis (L.) Kurz.

Hab.: Alor, Atimelang, 750 m alt., not planted, *No. 61.* Vern. n.: *kafafi.*

Use: Bark pounded and placed on new wounds. Wood used as ridge pole of pyramidal house roofs.

Annotations: This is a stout woody climber, which does not tally with its use. It is widely distributed in the Mal. Archipelago.

Moraceae.

40. Antiaris toxicaria Lesch.

Hab.: Alor, Atimelang, rare, not planted, *No. 32.* Vern. n.: *naboe.*

Use: May be used as firewood, not used otherwise.

Annotations: The material is sterile, though the identification seems safe. The three is known from India and Malaysia, and is recorded from Kwantung (S. China) in the precincts of a temple. The chief use of it is in the latex in other islands of Malaysia as a dart poison. The famous "upas" tree about which so much exaggerated information was put forward some centuries ago.

41. Artocarpus incisus (Thunb.) L. f.

Synonyms: *Rademachia incisa* Thunb., *Artocarpus communis* Forst.

Hab.: Alor, Atimelang, 750 m alt., planted, plentiful, *No. 71.* Vern. n.: *song.*

Use: Pulp eaten raw, seed boiled with corn or meat, sap used as glue in hafting blades or arrow points.

Annotations: Possibly imported at an early date from the Pacific, now cultivated throughout the tropics.

42. **Artocarpus integra** (Thunb.) Merr.

Hab.: Alor, Atimelang, 750 m alt., planted and volunteer, plentiful, *No. 95.* Vern. n.: *bata song.*

Use: Pulp of fruit is eaten raw; seeds cut up and boiled with corn or meat.

Annotations: A tree of India brought by cultivation into Malaysia.

43. **Ficus ampelas** Burm.

Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 34.* Vern. n.: *ria.*

Use: Fruit boiled, eaten mixed with maize or alone.

Annotations: I have never heard of this use. In Java the leaves are only used for substitute of emery-paper. Native throughout the Archipelago.

44. **Ficus callosa** Willd.

Synonyms: *Ficus quadridentata* Miq.

Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 89.* Vern. n.: *wodka.*

Use: Shelled, soaked for one day boiled, mixed with maize.

Annotations: I have never heard that fruits of this species are eaten. It is a common species in Malaysia.

45. **Ficus cf. infectoria** Roxb.

Hab.: Alor, Atimelang, 750 m alt., rare, not planted, *No. 94.* Vern. n.: *tame.*

Use: Roots used to make women's bark cloth and loin clothes.

Annotations: A large tree throughout India and Malaysia. The fibre was used for clothing also in Celebes.

46. **Ficus variegata** L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 51.* Vern. n.: *kaboeti.*

Use: Inner bark used to make bark cloth for women's loin cloth. Sap used to smear in cracks of spit kettle drums (mokos) to tighten them up.

Annotations: A big tree throughout India and Malaysia. In the eastern parts of the Archipelago cloth is made from the bark.

47. **Ficus** sp.

Hab.: Alot, Atimelang, 750 m alt., not planted, *No. 16.* Vern. n.: *firng.*

Use: Inner bark used for bow strings.

Annotations: The material of this apparently climbing species is insufficient for identification.

Moringaceae.

48. **Moringa oleifera** Lamk.

Hab.: Alot, Atimelang, 750 m alt., planted, rare, *No. 56.* Vern. n.: *matóling.*

Use: Leaves mixed with maize or meat and boiled.

Annotations: The horse-radish tree is wild in N. India and now spread in cultivation throughout the tropics.

Musaceae.

49. Musa paradisiaca L.

a. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 78.* Vern. n.: *foe miha.*

Use: Fruit roasted or boiled, not eaten raw! Flowers are eaten boiled.

b. Hab.: Alor, Atimelang, 750 m alt., planted, plentiful, *No. 79.* Vern. n.: *mosa kang or balej.*

Use: Fruit boiled or roasted, not eaten raw. Skins fed to pigs. Flowers not eaten.

c. Hab.: Alor, Atimelang, 750 m alt., plentiful, *No. 80.* Vern. n.: *farang.*

Use: Fruit roasted or boiled, not eaten raw. Flower boiled and eaten.

d. Hab.: Alor, Atimelang, 750 m alt., planted, plentiful, *No. 87.* Vern. n.: *kala miha.*

Use: Fruit eaten boiled, or roasted, not eaten raw. Flowers not eaten.

e. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 88.* Vern. n.: *marang.*

Use: Fruit roasted or boiled, sometimes eaten raw. Flowers eaten either boiled or raw.

f. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 93.* Vern. n.: *kapalata.*

Use: Fruit boiled or roasted, not eaten raw. Flowers eaten boiled.

Annotations: Banana is cultivated so widely that the origin of the cultigen races cannot be traced any more.

Palmae

50. Areca Catechu L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 24.* Vern. n.: *foe.*

Use: Fruits chewed with sirih and lime. Usually ¼ of the nut is considered a portion for one chew.

Annotations: Assumed to be of Malaysian origin, now established in cultivation as far as Formosa and S. China, Madagascar, East Africa, Fiji. Furnishes the betèl nut, indispensable in chewing sirih.

51. Arenga ?pinnata (Wurmb) Merr.

Synonyms: *Arenga saccharifera* Labill.

a. Hab.: Alor, Atimelang, 750 m alt., rare, *No. 72.* Vern. n.: *toeok.*

Use: Leaves used to weave small containers in which rice is cooked for feasts. Midribs of leaves used for brooms (modern). Fibres used for tinder in strike-a-lights.

b. Hab.: Alor, Atimelang, 750 m alt., rare, one tree in valley, not planted, *No. 50.* Vern. n.: *kamoeri.*

Use: Bark used as rope material in house building, rat traps, etc.

Annotations: The material is sterile and might also belong to *A. obtusifolia* Mart. It is peculiar that no mention is made of collecting palm sugar or toddy from this species. The native name "toeok" suggests that toddy is made from its tapped juice. The species occurs throughout Malaysia, both wild and planted.

Piperaceae.

52. Piper betle L.

Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, *No. 33.* Vern. n.: *meting.*

Use: Catkin chewed with *Areca* or tabaco and lime. Leaves only chewed when no catkins are available.

Annotations: This climbing pepper, the common "sirih" is a native of Malaysia, Madagascar and East Africa.

Rutaceae.

53. Citrus aurantifolia (L.) Swingle.

Hab.: Alor, Atimelang, 750 m alt., plentiful (?), planted, *No. 31.* Vern. n.: *moeri.*

Annotations: One of the commonest cultivated limes, cultivated throughout Malaysia, certainly introduced.

54. Citrus hystrix DC.

Hab.: Alor, Atimelang, 750 m alt., very rarely planted, *No. 10.* Vern. n.: *ati moeri* (= salt citrus fruit).

Use: Leaves pounded with salt or lombok, and used as seasoning. Recently introduced from the coast.

Annotations: A very distinct species, certainly introduced in Malaysia.

Sapindaceae.

55. Schleichera oleosa (L.) Merr.

Synonyms: *Schleichera trijuga* Willd.

Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 25.* Vern. n.: *kálang.*

Use: Fruit eaten boiled. Recently introduced from the coast.

Annotations: Deciduous tree in distribution apparently bound to a climate with a dry season, native in S.E. Asia and S.E. Malaysia, not occurring in Sumatra, Borneo and the Malay Peninsula.

Solanaceae.

56. Capsicum annuum L.

a. Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 41.* Vern. n.: *loekai foka* (foka = large).

Use: Mashed with salt and used as seasoning. Imported from the coast in the last 3—4 years.

b. Hab.: Alor, Atimelang, 750 m alt., plentiful, planted, volunteers, *No. 42.* Vern. n.: *loekai lohoe* (lohoe = long).

Use: Fruit mashed with salt, used as relish with maize.

Annotations: The chilly plant is an annual now cultivated all round the world; originally American. Columbus himself first brought the fruit to Europe.

57. **Nicotiana tabacum** L.
Hab.: Alor, Atimelang, 750 m alt., planted, *No. D.* Vern. n.: *talak.*
Annotations: Tobacco is introduced from the New World and is cultivated by the native peoples throughout Malaysia.

58. **Solanum melongena** L.
Hab.: Alor, Atimelang, 750 m alt., rare, planted, *No. 84.* Vern. n.: *trong.*
Use: Fruit roasted or boiled with meat or ocrn. Often eaten with salt and lombok relish. Introduced ca. 25 years ago by a local man called kapitan Jacob.
Annotations: The egg-plant is a native of S.E. Asia, now cultivated throughout the tropics, in Malaysia already cultivated in ancient time.

Sterculiaceae.

59. **Melochia umbellata** (Houtt.) Stapf.
Hab.: Alor, Atimelang, 750 m alt., *No. A.* Vern. n.: *wangai.*
Annotations: A small tree or large shrub from India, and also in Malaysia widely spread, which is perhaps due to cultivation. A very fast grower of otherwise little use.

Umbelliferae.

60. **Centella asiatica** (L.) Urban.
Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 85.* Vern. n.: *tohabik.*
Use: Leaves seared and laid on navel of new-born child after umbilical cord has been cut to produce rapid healing.
Annotations: A creeping weed, widely distributed throughout the tropics with an extensive medicinal reputation in Malaysia.

Zingiberaceae.

61. **Kaempferia galanga** L.
Hab.: Alor, Atimelang, 750 m alt., plentiful, not planted, *No. 82.* Vern. n.: *tohoe.*
Use: Tubers are boiled with corn, or made into a gruel to drink. Roots also pounded into a paste and smeared on wounds morning and evening. This last medical use is combined with magical properties and is owned by one individual.
Annotations: A herb from India and cultivated throughout Malaysia.

22. ON THE DATE OF PUBLICATION OF BLUME'S "PLANCHES INÉDITES".

In the library of the Rijksherbarium, Leyden, I found by chance an advertisement of Blume's "Planches Inédites" which, to the knowledge of Danser (Blumea 3 (1939) 203—211, specially p. 402, 410) were offered for sale only since 1897 by the booksellers "Burgersdijk & Niermans" who in that year bought them from Van der Hoek's. It was assumed that Van der Hoek never offered them for sale.

In a copy of Blume's "Enumeratio" (former property of P. W. Korthals) I found a notice of Van der Hoek's, however, printed on the back of "Pl. Inédit t. VII B" which runs: "*Oeuvres de feu de Mr. C. L. Blume*". "*Dans le Magasin Van der Hoek Frères Libraires à Leide, sont encore à avoir un petit nombre d'exemplaires de ...*", and then follows a complete list of the fascicles of Flora Javae, Rumphia, Museum Botanicum, Bijdragen tot de Flora van Nederlandsch Indië, Naamlijst der gewassen *&c*, Enumeratio plantarum Javae *&c*., several separate sets, the uncoloured edition, separate parts, *&c*. Among these is also mentioned:

"*Quelques exemplaires, d'un Cahier de 23 planches coloriées inédites savoir: Loranthae pl. 29—32. — Filices, pl. 95 et 96. — Rhododendron, pl. 1—VII c. — Amphicalyx, pl. 9 — Gaultheria, pl. 13—15. — Vaccinium, pl. 19, 20, 23 et 24. Sans texte. .... fl. 2.50*"

Somebody wrote in ink in the margin left of it: "*NB*" to draw attention, and sent the advertisement to someone else, possibly Korthals, as at the bottom of the advertisement is written in the same handwriting: "*Amice, in dit cahier komt pl. 95 en 96 der Filices voor, zijnde niet verder vervolgd*" (My Friend, in this "cahier" pl. 96 and 97 are present of the Filices, which have not been continued).

The date of publication (issue) is now narrowed to after 1862 (Blume's death) and before 1897 when Burgersdijks *&c*. bought the copies from Van der Hoek's. Much depends on the identification of the handwriting. In Leyden, through the care of the Staff, mostly Miss Koster's and Dr Van Ooststroom's many specimens of handwriting have been collected, and it appears that Buese's handwriting is very much the same as the one sought after. Buese died 1888; Korthals to whom the advertisement might have been addressed died 1892.

In each case it appears that Blume's Planches Inédites were offered for sale by Van der Hoek long before 1897, and later than 1862.

Through the care of Mr A. de Groot, of Van der Hoek's, a certain number of copies could be located in the store-house of the firm. Thanks to the generous offer of Mr de Groot these have been presented to botanical libraries; the remainder of the stock will be preserved in the Rijksherbarium, Leyden.

PS. Dr Venema informed me that a copy of the advertisement is also present in the library at Wageningen Agricultural College, probably formerly in the possession of Dr Valckenier Suringar. In the Catalogue of the Intern. Colonial Exhibition, Amsterdam, 1883, an entry refers (l.c. p. 130) to an exhibited copy of the Flora Javae including the inedited plates which pushes at least the date back to 1883 (cf. Natuurwet. Tijdschr. Ned. Ind. 101, 1941, 316).

NOTES ON MALAY COMPOSITAE II

by

JOSÉPHINE TH. KOSTER

(Rijksherbarium, Leiden)

(Issued 1. VI. 1948).

After the possibility of studying type material from abroad had returned, a specimen of *Blumea acutata* DC. var. β from Timor, to which was added a label with the handwriting of Decaisne, was seen by me, thanks to the kindness of the Director of the "Museum National d'Histoire Naturelle", Paris. *Blumea acutata* DC. var. β (Prodr. V, 1836, 438) differs from the species, according to the description principally in the shape of the lower leaves, which, however, are lacking in the specimen seen by me. After examining the receptacle, it appeared, that it was hairy like that of *Blumea intermedia* Koster (in Blumea IV, 1941, 486), whereas no other reason was found to separate this species from *Blumea acutata* DC. var. β. However, during a visit to the "Conservatoire et Jardin Botaniques", Geneva, the Director kindly allowed me to inspect the species of *Blumea* in the herbarium De Candolle, which is like a natural illustration to the Prodromus. As under the name *Blumea acutata* DC. (in Decaisne in Nouv. Ann. Mus. d'Hist. nat. T. 3, 1834, 409) three different forms allied to *Blumea lacera* (Burm.) DC. were found, it seems reasonable to keep the name *Blumea intermedia* upright.

On the other hand it is no longer justified to consider *Blumea floresiana* (Schultz-Bip.) Boerl. (Fl. Ned. Ind. II, 1899, 239) a variety of *Blumea acutata* DC. as was done by the present author in Blumea IV, 1941, 488. So the species *Blumea floresiana* (Schultz-Bip.) Boerl. must be kept upright.

Still other interesting facts came to light during the inspection of the herbarium De Candolle.

Blumea humifusa (Miq.) Clarke (Comp. ind., 1876, 72) appeared to be a synonym of *Blumea tenella* DC. (Prodr. V, 1836, 433), of which fact Backer (Handb. Suikerr. Java VII, 1934, 766) had noticed the probability already. *Blumea amplectens* DC. is allied to this species, but is has a different general appearance. After the statement, made above, *Blumea humifusa* (Miq.) Clarke var. *monochasialis* Koster (l. c. 489) must be named *Blumea tenella* DC. var. *monochasialis* (Koster) Koster.

Blumea lacera (Burm.) DC. var. *burmanni* DC. (Prodr. V, 1836, 436) had perhaps better not be considered a variety, though its leaves are fairly profoundly incised.

Blumea runcinata DC. (l. c. 438) is a synonym of *Blumea lacera* (Burm.) DC.; it was considered a separate species by Miquel (Fl. ind. bat. II, 1856, 46) and Clarke (l. c. 78).

Blumea fasciculata DC. (l. c. 442) is a synonym of *Blumea sessiliflora* Decaisne (l.c. 410), a variable species described from Timor and also found on Java. In the herbarium De Candolle a specimen on which Decaisne himself has written "Pluchea sessiliflora nob." is to be found under the name *Blumea fasciculata.* Clarke (l. c. 81) unites a number of species of De Candolle, *Bl. fasciculata, racemosa, glomerata, gracilis, purpurea, leptoclada* and *holosericea*, under the first name, which was changed by Kurz (in Journ. As. Soc. Bengal 46, 2, 1877, 187) into *Blumea fistulosa* (Roxb.) Kurz. Hooker (Fl. Br. Ind. III, 1882, 262) used the name *Blumea glomerata* DC. for the species. All three authors, however, described the receptacle of this species to be velvety or pubescent, sometimes, moreover, having long white hairs. The Javanese specimens, like the type specimen, as to Decaisne's description, have a glabrous receptacle, now and then with very few short central hairs, or the receptacle is minutely fringed around the central alveoles. The specimen of *Blumea glomerata* in the herbarium De Candolle has smaller heads than *Blumea sessiliflora. Blumea leptoclada* DC. is a synonym of *Blumea glomerata.* It seems to be advisable to keep the two species, *Bl. sessiliflora* Decaisne and *Blumea fistulosa* (Roxb.) Kurz. separate, though they are closely related.

Under the name *Blumea chinensis* (L.) DC. we find in the herbarium De Candolle three specimens of *Blumea riparia* (Bl.) DC. and one of *Blumea bullata* Koster (l. c. 489) and also the species *Blumea semivestita* DC. (l. c. 445) in the herbarium De Candolle is a mixture of these two species. *Blumea semivestita* DC. is mostly treated as a synonym of *Blumea procera* DC. (Clarke l. c. 86, Hooker l. c. 268, Gagnepain in Lec. Fl. Indo-Chine III, 1924, 528). Unfortunately the heads of *Blumea procera* DC. are very young in the specimen in the herbarium De Candolle; this species is related to *Blumea bullata* Koster.

Summary:

The names *Blumea intermedia* Koster (syn. *Bl. acutata* DC. var. *β*) and *Blumea floresiana* (Schultz-Bip.) Boerl. must be kept upright.

Blumea humifusa (Miq.) Clarke var. *monochasialis* Koster has to be changed into *Blumea tenella* DC. var. *monochasialis* (Koster) Koster, for *Blumea humifusa* (Miq.) Clarke is a synonym of *Blumea tenella* DC.

Blumea lacera (Burm.) DC. var. *burmanni* DC. is not a clearly distinguishable variety.

Blumea runcinata DC. is a synonym of *Blumea lacera* (Burm.) DC.

Blumea fasciculata DC. is a synonym of *Blumea sessiliflora* Decaisne, which is not a synonym of the closely related *Blumea fistulosa* (Roxb.) Kurz (syn. *Bl. glomerata* DC. and *Bl. leptoclada* DC.).

Blumea chinensis (L.) DC. as well as *Blumea semivestita* DC. are a mixture of *Blumea riparia* (Bl.) DC. and *Blumea bullata* Koster.

PLANTS COLLECTED BY TH. HERZOG ON HIS SECOND BOLIVIAN JOURNEY, 1910—1911

Part VIII

COMPOSITAE

(continued)

JOSÉPHINE TH. KOSTER
(Rijksherbarium, Leiden)

(Issued 1. VI. 1948).

EUPATORIEAE.

Ageratinae.

Stevia Cav.

After a paper had been published i. a. on the species of *Stevia* of the collection mentioned in the heading [1]) another *Stevia* from the same collection came into the author's hands. It proved to be new. The American genus *Stevia* has been treated in local revisions by B. L. Robinson (in Gray Herb. Harvard Univ. V, 90, 1930, 36—159; 96, 1931, 28—49; 100, 1932, 20—69). Its floral characters are fairly uniform, but the pappus shows a great diversity. The 5 achenes in a head do not mature at the same time. The genus Stevia seems to have its greatest development in Bolivia, where it is represented by 44 species. The next representation is in Peru with 24 and in Argentina with 23 species.

Section *Eustevia* Robinson.

Stevia pauciflora Koster, nov. spec. (*fig. 1—6*) — Herbacea parva, 11—16 cm alta, ramosa, ad basin caulibus pluribus, rhizomatibus praedita, radicibus copiosis. Caules tenues, pubescentes, subteretes, obscuriter striati, purpurascentes, ½—1 mm crassi, ad basin squamis lanceolatis, minutis, siccis, confertis praediti; internodiis ½—3 cm longis. Folia opposita, subsessilia vel breviter petiolata, parva, anguste elliptico-lanceolata, ad basin sensim in petiolum attenuata, apice obtusa, sparse dentata (dentibus 4—8), firma, pallide olivacea (in sicco), utrinque dense glandulosa-punctata, glabra, trinervia, nervis prominentibus subtus, ½—3 cm longa, 1½—5 mm lata. Capitula pauca, 3, interdum 4, conferta, terminalia vel ad apice pedunculi tenuis pubescentis, bracteis minutis saepe praediti, in axillis superioribus 2, breviter pedunculata (pedunculis 1—1½ mm longis in axilla bracteae minutae) vel subsessilia, cylindrica, 5-flora, 9 mm longa, 1½ mm crassa;

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[1]) in Blumea 5, n. 3, 1945, 641—685.

involucrum cylindricum, 4—5 mm longum, squamis 5, elliptico-lanceolatis, longitudine inaequantibus, naviculiformibus, apice acutis, dorso glandulosis, pubescentibus, striatis. Flores bisexuales, 9 mm longi; corolla tubulosa, apice 5-lobata, glandulosa, 5 mm longa, lobis obtusis. Antherae apice insigne appendiculatae, obtusae, ad basin obtusae. Styli rami longi, tenues, apice acuti. Achenium turbinato-oblongum, 5-costatum, glabrum, nigrescens, 4 mm longum; pappus omnium acheniorum similis ex paucis paleis membranaceis, minutis, apice laciniatis cum 3 setis filiformibus, scabris, 4 mm longis. Receptaculum parvum, planum, nudum.

Hab.: an trockenen, felsigen Abhängen im Caipipendithal, 1000 m alt.; Dez. 1910, *n. 1228*.

The type is preserved in the Rijksherbarium, Leiden.

Obs.: This species is closely allied to *Stevia chamaedrys* Griseb., which, however, differs by the shape of the leaves and the much longer involucre, according to the original diagnosis. Moreover, Robinson describes its leaves to be membranaceous and pubescent and its inflorescences to exist of dense glomerules.

HELIANTHEAE.

While studying this difficult group I enjoyed the indispensable help of Dr S. F. Blake, Washington.

Millerinae.

Clibadium L.

Clibadium surinamense L., Mant. 2, 1771, 294; DC., Prodr. 5, 1836, 505; Baker in Mart., Fl. Bras. 6, 3, 1882—1884, 151; Schulz in Engl., Bot. Jahrb. 46, 1912, 617; Knuth in Fedde, Repert. Spec. nov. regni veg., Beih. 43, 1928, 711; Moore in Fawcett and Rendle, Fl. Jamaica 7, 1936, 210, fig. 65; Koster in Pulle, Fl. Surinam. 4, 2, 1938, 137 — *Clibadium peruvianum* Poepp. in DC., Prodr. 5, 1836, 505; Schulz in Engl., Bot. Jahrb. 46, 1912, 620.

Hab.: Hochstaude oder spreizender Strauch an der Waldgrenze bei Tres Cruces (Cordillera de Santa Cruz), 1450 m alt., Febr. 1911, Bl. crêmeweiss, *n. 1533*.

Distr.: West Indies, Costarica, Panama, Colombia, Venezuela, Guyana, Brasil, Peru, Bolivia.

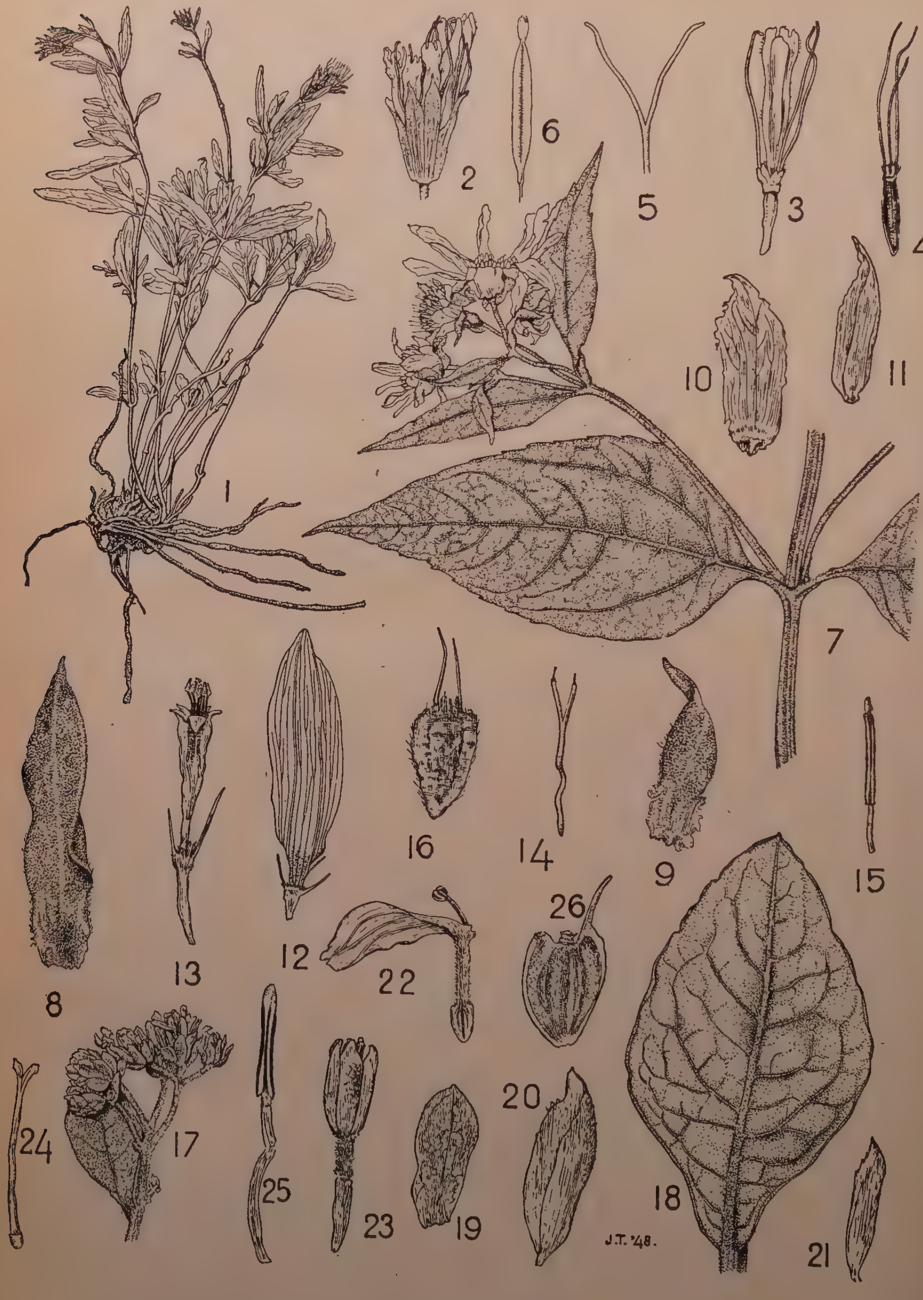
Ambrosinae.

Ambrosia L.

Ambrosia elatior L. Spec. Pl., 1753, 987; Small, Man. S. E. Flora. 1933, 1300; Giscafre et Ragonese in Darwiniana 6, 1942, 35 — *Ambrosia artemisiifolia* Auct. non L.

Hab.: in Potreros um Villa Montes häufig, 460 m alt., Nov. 1910, *n. 1123*.

Distr.: North, Central and South America, escaped to Europe.


J.T. '48.

Zinninae.

Sanvitalia Lam.

The following species was identified by Dr S. F. Blake, Washington.

Sanvitalia versicolor Grisebach in Abh. Kön. Ges. Wiss. Gött. 24, 1879, 189; Fries in Ark. f. Bot. 5, 1906, 18.

Hab.: in der Felssteppe bei Comarapa, 1900 m alt., April 1911, *n. 1890.*

Distr.: Bolivia, Argentina.

Verbesininae.

Wedelia Jacq.

Wedelia aff. **goyazensis** Gardn. in Hook., London Journ. Bot. 6, 1847, 288; Baker in Mart., Fl. Bras. 6, 3, 1882—1884, 189.

Hab.: Spreizklimmer im Gebüsch zwischen Cumbarute und Majado, 800 m alt., Dez. 1910, *n. 1174*; klimmend im Buschwald bei Villa Montes (Rio Pilcomayo), 460 m alt., *n. 1122.*

Obs.: Because of the achenes being immature, important characters of the species could not be studied. Leaves cuneate or rotundate at the base.

Wedelia brachycarpa Baker in Mart., Fl. Bras. 6, 3, 1882—1884, 181 — *Viguiera spec. no 1317* Beauverd in Herzog, Pfl. boliv. And., 1923, 115.

Hab.: in Potreros zwischen Gebüsch bei Santa Cruz, 450 m alt., Jan. 1911, *n. 1317.*

Distr.: Paraguay.

Obs.: Peduncles 2—9 cm long.

Oyedaea DC.

Oyedaea bullata Koster, nov. spec. (*fig. 7—16*) — Fruticosa; rami angulosi, parte superiore 2—4 mm crassi, sordide hirti; internodiis 4—6 cm longis. Folia opposita, breviter petiolata, petiolis 1—½ cm longis, superioribus subalatis, superiora sessilia, elliptica-oblonga, utrinque gradatim attenuata, apice longiter acuminata, acutissima, serrata, chartacea, bullata, utrinque aspera, pilis brevibus, rigidis, pinninervia, subtrinervia, reticulatione subtus prominente, supra obscure viridia, subtus pallidiora, 9—18 cm longa, 2½—7½ cm lata, superiora minora. Capitula numerosa, corymbosa, (inflorescentia foliosa, foliis parvis), interdum solitaria in axillis foliorum superiorum, pedunculata, pedunculo 1—5½ cm longo, interdum folio parvo praedito, 5 cm diam., 12 mm alta. Involucrum campanulatum, 3—4-seriatum, squamis oblongis, exterioribus laxis, apice acutissimis, supra asperis,

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Fig. 1—6. *Stevia pauciflora* Koster, nov. spec.; 1: flowering plant (× ½); 2: head (× 2½); 3: flower (× 3½); 4: achene (× 2½); 5: style (× 9); 6: stamen (× 12½) — 7—16. *Oyedaea bullata* Koster, nov. spec.; 7: part of flowering plant (× ½); 8: outer involucral bract (mature, × 4); 9: the same (young, × 4); 10: inner involucral bract (× 4); 11: palea of receptacle (× 4); 12: ray-flower (× 1½); 13: disk-flower (× 3½); 14: style (× 3½); 15: stamen (× 3½); 16: achene of disk-flower (× 3) — 17—26. *Verbesina rhomboidea* Koster, nov. spec.; 17: part of flowering plant (× ¾); 18: leaf (× 1); 19: outer involucral bract (× 4½); 20: inner involucral bract (× 4½); 21: palea of receptacle (× 2½); 22: ray-flower (× 4); 23: disk-flower (× 3½); 24: style (× 2½); 25: stamen (× 7½); 26: achene of disk-flower (× 3).

subtus hirtellis, foliaceis, basi rigidis, 11 mm longis, deinde longioribus, interioribus apice subacutis, vel subrotundatis, glabris, stramineis, brevioribus. Flores radii steriles, 10—15, lutei; corolla ligulata, apice 3-dentata, dentibus brevibus, 2 cm longa, 7 mm lata. Antherae et stylus desunt. Achenium rudimentum turbinatum, triquetrum, glabrum, marginibus ciliatis exceptis; pappi setae 3, achenio longioribus, squamellae parvae, laciniatae. Flores disci bisexuales, numerosi; corolla tubulosa, apice 5-dentata, dentibus acutis, basi abrupte attenuata, lutea, 6 mm longa. Antherae ad basin brevissime sagittatae, apice acutae. Styli rami breves, apice primo deltoidei, deinde abrupte attenuati, acuminati. Achenium ovatum, a lateribus compressum, marginibus ciliatis, alatum, 5 mm longum, 3½ mm latum; pappi setae 2, achenio aequilongae vel breviores, inaequales, basin versus dilatatae, plus minusve caducis, squamellae plures, parvae, lanceolatae, apice dentatae. Receptaculum paleaceum, paleis naviculiformibus, flores disci subinvolventibus, carinatis, apice acutis.

Hab.: Strauch im Gebüsch um Incaconal, sehr häufig, 2500 m alt., Juni 1911, *n. 2244.*

The type is preserved in the Rijksherbarium, Leiden.

Obs.: Allied to *O. boliviana* Britton, but to be distinguished by the bullate leaves and especially by the involucrum.

Verbesina L.

Section Ochractinia Robinson et Greenman in Contr. Gray Herb. Harv. Univ. N. S. 1, 16, 1899, 559.

Verbesina macrophylla (Cass.) Blake in Bull. Torrey Bot. Club 5, 1924—1925, 430 — *Verbesina diversifolia* DC., Prodr. 5, 1836, 615; Benth. et Hook., Gen. Pl. 2, 1876, 380; Baker, in Mart., Fl. Bras. 6, 3, 1882—1884, 213, t. 65; Robinson and Greenman in Contr. Gray Herb. Harv. Univ. N. S. 1, 16, 1899, 562; Rusby in Bull. N. Y. Bot. Gard. 4, 1907, 389 — *Verbesina pinnatifida* var. *subintegra* Beauverd in Herzog, Pfl. boliv. And., 1923, 142.

Hab.: Hecken um Samaipata, 1700 m alt., Bl.weiss, März 1911, *n. 1668.*

Distr.: Colombia, Brasil.

Obs.: A large form, of which the upper leaves are 22 cm long, 13 cm broad, the heads 5—6 mm thick, 8—10 mm long.

Section Lipactinia Robinson and Greenman in Contr. Gray Herb. Harv. Univ. N. S. I, 16, 1899, 563.

Verbesina flavovirens R. E. Fries in Ark. f. Bot. 5, 1906, 19, t. 2, fig. 1—3.

Hab.: im niederen Gebüsch der Bergkämme bei Tres Cruces, circa 1450 m alt., Bl.gelb, März 1911, *n. 1545.*

Distr.: Bolivia.

Obs.: Stem narrowly alated in some places; wing about 1 mm broad; ligulate flowers in the heads 0—5.

Verbesina rhomboidea Koster, nov. spec. (*fig. 17—26*) — Fruticosa; rami lignosi, teretes, iuveniles curvati, striati, pilosi, pilis ad basin tumidis praediti, deinde glabrescentes, lenticellati; internodiis 1—2 cm longis. Folia alterna, sessilia vel subpetiolata, subrhomboidea vel elliptica vel ovato-elliptica, apice acuti, ad basin cuneati, crenati, margibus revolutis, chartacea, pinninervia (nervis utroque circa 8), superne basibus pilorum caducorum scabra, subtus pallidiora, nervis prominentibus, strigosis, reticulatione ampla, 4—5½ cm longa, 2½—4 cm lata, superiores minores. Capitula plura, subcorymbosa, pedunculata, pedunculo ferrugineo vel cinereo, piloso ut rami iuveniles, saepe folio parvo lanceolato, ½—1 mm longo praedito, ½—1 cm longo, 1 cm alta, 5—7 mm diam. Involucrum campanulatum, 2—3-seriatum, 6 mm longum; squamis decrescentibus, laxis, oblongis, apice subacutis, pubescentibus, margine ciliatis, subfoliaceis, subcrassis, interioribus naviculiformibus. Flores radii feminei, pauci, (2—7), breves; corolla ligulata, lutea, ligula late elliptica, 3-dentata, dentibus obtusis, striata, glabra, ± ½ cm longa, 2½ mm lata, tubo piloso, 2 mm longo. Antherae desunt. Styli rami breves, lineares, subobtusi. Achenium rudimentum, obovatum, a lateribus compressum, margine ciliatum; pappus deest. Flores disci bisexuales, pauci, circa 12; corolla tubulosa, apice 5-dentata, dentibus subacutis, parte inferiore angustiore dense, superiore parce pilosa, 5 mm longa. Antherae nigrae, ad basin breviter sagittatae, apice subobtusae, filamentis latis. Styli rami breves, lati, apice acuti et ciliati. Achenium maturum cordato-obovatum, a lateribus compressum, subtriquetrum, striatum, glabrum, angustissime alatum, margine parce ciliatum 5 mm longum, 3 mm latum; pappi arista 1,3 mm longa. Receptaculum paleaceum, paleis naviculiformibus, stramineis, apice acutis, dorso et margine ciliatis, 7 mm longis.

Hab.: kleiner Strauch auf dem Kamm der Laguna verde bei Comarapa, 2600 m alt., April 1911, *n. 1984.*

The type is preserved in the Rijksherbarium, Leiden.

Obs.: Allied to *V. laevifolia* Blake and *V. flavovirens* R. E. Fries, from which species it is different i. a. by the shape of the leaves. The new species belongs to the section *Lipactinia*, though the ligules are short. However, also in the species *V. flavovirens* and *V. grandifolia* Blake, belonging to the same section, the ligules are short.

Coreopsidinae.

Isostigma Less.

Isostigma hoffmannii O. Kuntze, Rev. Gen. Pl. 3, 2, 1898, 160; Beauverd in Herzog, Pfl. boliv. And., 1923, 155.

Hab.: in der Pampa von Santa Cruz, 450 m alt., Jan. 1911, *n. 1309.*

Distr.: Bolivia.

Chrysanthellum Rich.

The following species was identified by Dr S. F. Blake, Washington.

Chrysanthellum americanum (L.) Vatke in Bremen Abh. 9, 1885, 122; O. Kuntze, Rev. Gen. Pl. 3, 2, 1898, 141; Knuth in Fedde, Repert., Spec. nov. regni veg., Beih. 43, 1928, 722; Moore in Fawcett et Rendle, Fl. Jamaica 7, 1936, 256, fig. 87 — *Chr. procumbens* Rich. in Pers. Syn. 2, 1807, 471; DC., Prodr. 5, 1836, 630; Grisebach, Fl. Br. West Ind. Isl., 1864, 377; in Abh. Kön. Ges. Wiss. Gött. 19, 1874, 139; 24, 1879, 198.

Hab.: auf Bergtriften um Samaipata, 1900 m alt., März 1911, *n. 1673*, "Anisillo"; Gebüschen um Samaipata, ca 1800 m alt., *n. 1669/a.*

Distr.: Central America, West Indies, Venezuela, Bolivia, Brasil.

Heterosperma Cav.

The following species was identified by Dr S. F. Blake, Washington.

Heterosperma diversifolium H. B. K., Nov. Gen. et Spec. 4, 1820, 226, t. 384; Grisebach in Abh. Kön. Ges. Wiss. Gött. 24, 1879, 198; Hieronymus in Engl. Bot. Jahrb. 36, 1905, 495; Rusby in Bull. N. Y. Bot. Gard. 4, 1907, 389.

Hab.: auf Bergtriften um Samaipata, 1900 m alt., März 1911, *n. 1677/a.*

Distr.: Ecuador, Peru, Bolivia, Argentina (Andes).

Obs.: A species very variable in leaf form (Dr S. F. Blake).

Bidens L.

Section Greenmannia Sherff in Bot. Gaz. 88, 1929, 297; Sherff in Publ. Field Mus. Nat. Hist. Bot. Ser. 16, 1937, 31.

Bidens squarrosa H. B. K., Nov. Gen. et Spec. 4, 1820, 238; DC., Prodr. 5, 1836, 599; Knuth in Fedde, Repert. Spec. regni veg. Beih. 43, 1928, 724; Sherff in Publ. Field Mus. Nat. Hist. Bot. Ser. 16, 1937, 179 Pl. 44, 45, fig. a—g.

Hab.: an der Cuesta de Piedra Borracha hoch in die Bäume kletternd, 1400—1700 m alt., März 1911, *n. 1741.*

Distr.: Central America, West Indies, Venezuela, Colombia, Brasil, Peru, Bolivia.

Section Psilocarpaea DC., Prodr. 5, 1836, 596; Sherff in Publ. Field Mus. Nat. Hist. Bot. Ser. 16, 1937, 32.

Bidens andicola H. B. K., Nov. Gen. et Spec. 4, 1820, 237; DC., Prodr. 5, 1836, 599; Weddell, Chlor. And. 1, 1855, 69; Schultz-Bip. in Bull. Soc. Bot. de France 12, 1865, 79; Klatt in Engl., Bot. Jahrb. 8, 1887, 44; Britton in Bull. Torrey Bot. Club 19, 1892, 150; Rusby in Mem. Torrey Bot. Club 3, 1893, 60; O. Kuntze, Rev. Gen. Pl., 3, 2, 1898, 136; Hieronymus in Engl., Bot. Jahrb. 28, 1901, 614; Sidoro, eod. 29, 1901, 48; Hieronymus, eod. 36, 1905, 496; R. E. Fries in Nov. Act. Sci. Upsal. Ser. 4, 1, 1905, 84; Buchtien, Contr. Fl. de Bolivia, 1910, 193; Perkins in Engl., Bot. Jahrb. 49, 1913, 228; Beauverd in Herzog, Pfl. Boliv. And., 1923, 216; Sherff in Publ. Field Mus. Nat. Hist. Bot. Ser. 16, 1937, 494, Pl. CXXIII fig. a—d, h—p.

Hab.: auf Wiesen der hohen Bergkämme bei Comarapa, 2600 m alt., April 1911, *n. 1942.*

Distr.: Venezuela, Colombia, Ecuador, Peru, Bolivia, Northern Argentina.

Bidens triplinervia H. B. K. var. **macrantha** (Wedd.) Sherff in Bot. Gaz. 80, 1925, 383; Sherff in Publ. Field Mus. Nat. Hist. Bot. Ser. 16, 1937, 510, Pl. CXXVI fig. a—i, l—v, CXXVIII fig. j—p — *Bidens humilis* H. B. K., Nov. Gen. et Spec. 4, 1820, 183; Weddell, Chlor. And. 1, 1855, 69 (cum var. *macrantha*); Schultz-Bip. in Bull. Soc. Bot. de France 12, 1865, 79; Schultz-Bip. in Linnaea 18, 1866, 528; Knuth in Fedde, Repert. regni veg. Beih. 43, 1928, 723 — *Bidens grandiflorus* Balb. var. *humilis* (H. B. K.) O. Kuntze, Rev. Gen. Pl. 3, 2, 1898, 136.

Hab.: am Cerro Oruro auf steinigen trockenen Boden, 3800 m alt., Nov. 1911, *n. 2522/b.*

Distr.: Mexico, Guatemala, Venezuela, Colombia, Ecuador, Peru, Bolivia, Chili, Argentina.

Obs.: Small plants, up to 60 cm long, with heads, 1½ cm in diam.

Cosmos Cav.

Cosmos peucedanifolius Wedd., Chlor. And. 1, 1855, 70; Beauverd in Herzog, Pfl. boliv. And., 1923, 181; Sherff in Publ. Field Mus. Nat. Hist. Bot. Ser. 8, 1932, 439 — *Cosmos diversifolius* Beauverd in Herzog, Pfl. boliv. And., 1923, 144.

Hab.: auf Bergwiesen des "Fuerte" bei Samaipata, 1900 m alt., März 1911, Bl.rosa, *n. 1771*; auf steinigen Triften am Gipfel des Berges über Vallegrande, 2550 m alt., März 1911, Bl.rosa, *n. 1795*.

Distr.: Peru, Southern Bolivia (Andes).

Galinsoginae.

Calea L.

Section Leontophthalmum (Willd.) DC., Prodr. 5, 1836, 675.

The following species was identified by Dr S. F. Blake, Washington.

Calea coriacea DC., Prodr. 5, 1836, 675; Blake in Contr. U. S. Nat. Herb. 26, 1940, 258.

Hab.: Charakterstrauch der Buschregion von Tres Cruces, 1450 m alt., März 1911, Bl.gelb, *n. 1685*; Comarapa, s. n.

Distr.: Bolivia.

Obs.: Heads solitary. Dr S. F. Blake observed about this species:

"This seems to me to be merely a phase of *C. coriacea* DC. (of which *C. robusta* Britton is a synonym; see Contr. U. S. Nat. Herb. 26: 258, 1930), with solitary heads. The leaves are scarcely cordate and rather more oblong than in nearly all specimens of *C. coriacea* examined, but they agree so precisely in texture, venation, in the peculiar papillose roughness of the upper surface and the impressed glands of the glabrous lower surface, and the involucre, achene and pappus are so completely identical, that I cannot believe it is different from *C. coriacea*. Some of our specimens of that have very few heads, although none have them solitary."

Tridax L.

Tridax procumbens L., Spec. Pl. ed. 1, 1753, 900; DC., Prodr. 5, 1836, 679; Hoffmann in Engler-Prantl, Nat. Pfl. Fam. 4, 5, 1894, 247; Hieronymus in Engl. Bot. Jahrb. 19, 1894, 58; Rusby in Bull. N. Y. Bot. Gard. 4, 1907, 390; Schellenberg, Schinz und Thellung in Mém. Soc. Neuchatel Sci. Nat. 5, 1914, 428.

Hab.: am sandigen Ufer des Rio Pirai, 450 m alt., Jan. 1911, *n. 1433*.

Distr.: Central America, West Indies, Colombia, Bolivia, introduced into the Malay Archipelago and Mauritius.

THE NETHERLANDS' MARINE CLADOPHORA SPECIES

by

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(Issued 1. VI. 1948).

When studying the marine species of the genus *Cladophora* in the Netherlands, I had the disposal of the material of the National Herbarium at Leiden, the herbaria of the Universities of Amsterdam, Groningen and Utrecht and those of the "Zoölogisch Station" at Den Helder and the "Koninklijke Nederlandse Botanische Vereniging" at Leiden. It is a pleasure to me to express my best thanks to the directors of the Institutes mentioned above, for putting the material at my disposal, and to Miss Dr J. Th. Koster, who gave me much valuable help.

Especially the material of the National Herbarium at Leiden was very interesting to me, since it contains the herbaria of Kützing, Hauck, and very many reliable exsiccata, so it was possible to compare some Dutch species with the original specimens.

The herbarium of the "Zoölogisch Station" at Den Helder contains the collection of Van Goor, on which he based his observations on the marine Cladophora species in: Van Goor, "Die Holländischen Meeresalgen"; so I could check the determinations of Van Goor and compare his specimens with those in the herbarium of Kützing.

The genus *Cladophora* is known as a very difficult one, because the species are poor in adequate morphological characters. Moreover, the sterile parts are very dependent on environmental factors, such as salinity, current, temperature, insolation etc. A change in one or more of these factors may influence the growth of the algae and cause them to vary from the normal type. I therefore think it possible that under extreme conditions, such as exist in several localities in Zeeland, widely different species tend to develop the same phenotype, and may show different degrees of divergence from the type. This divergence may concern several features in which case identification must be based on a large number of specimens. Especially the dimensions, and, to a lesser degree the branching of the filaments and the number of the branches vary under the influence of the environment.

Bliding pointed out that the zoospores belonging to closely related species of *Cladophora* are different, so that it seems possible that they possess the more constant features on which identification may be based.

All the investigations, as well as the figures are based on herbarium material.

Van Goor collected specimens which he identified as *Cladophora albida* (Huds.) Kütz. (v. Goor, p. 126) at Zeeburg and Stavoren, and mentioned this species as new for the Netherlands. He based his determination on the description and the herbarium material of Kützing. I had the opportunity to compare both Van Goor's and Kützing's material with a specimen identified by Hudson (Kew Herbarium), and found that none of it belonged to *Cl. albida* (Huds.) Kütz. Van Goor's specimens appeared to be *Cl. refracta* (Roth.) Kütz., just as two specimens collected by Van den Bosch at "Zandkreek" and "Haven van Goes". *Cl. refracta* is very variable (diameter ultimate ramuli 40—120 μ), the specimens mentioned above are extraordinarily thin. As far as I know, *Cl. albida* has not been found in the Netherlands up to this time.

Hauck as well as De Toni and Van Goor mentioned *Cl. chlorothrix* Kütz. and *Cl. tenuis* Kütz. as synonyms of *Cl. albida* (Huds.) Kütz. Comparison of the types of *Cl. chlorothrix* and *Cl. tenuis* (National Herbarium, Leiden) with the specimen of *Cl. albida,* identified by Hudson (Herbarium Kew) shows, that both *Cl. chlorothrix* and *Cl. tenuis* differ from *Cl. albida* by their very long branches, which bear only very few ultimate ramuli with a smaller diameter than these branches and a smaller relative celllength (length times breadth). *Cl. chlorothrix* and *Cl. tenuis,* however, are synonyms; this species must be maintained, under the name *Cl. chlorothrix* Kütz.

Comparison of specimens of *Cl. laetevirens* (Dillw.) Kütz. identified by Dillwyn (Kew herbarium) with the specimens of that species in the herbaria Kützing and Van Goor showed that the specimens of Van Goor and Kützing belong to *Cl. flexuosa. Cl. laetevirens* has not been found in the Netherlands.

Van Goor (p. 120) mentions that the only specimen of *Cl. macallana* Harv., known from the Netherlands was lost, but I found it back in the material of the National Herbarium; the identification was correct.

The specimen of *Cl. glaucescens* (Griff.) Harv. found by Van Goor among *Zostera,* has some resemblance with the specimens of *Cl. flexuosa* Harv. of the herbarium Kützing and with exsiccates (Wyatt a. o.). Therefore, I do not believe that *Cl. glaucescens* was ever found in the Netherlands.

The specimen of *Cl. bertholini* Kütz. found by Suringar between Hoorn and Edam is to be found in the National Herbarium. On examination, it turned out to be *Cl. fracta.* No other specimen of *Cl. bertholini* was found, so we have to strike this species from the Flora of the Netherlands.

Cladophora fracta (Dillw.) Kütz. f. *marina* Hauck (p. 461) was considered by Børgesen (p. 18) as a separate species: *Cl. hauckii* Børg. Though Brand (p. 178) ascertains that *Cl. fracta* is not found in salt water, many specimens have been found in the Netherlands in brackish and even in salt water. There is a fair number of intermediate forms between *Cl. fracta* f. *marina* and *Cl. fracta* in existence. I am, therefore, of the opinion that the two forms are very closely related and that the differences between them are not important enough to distinguish two separate species, as was done by Brand (p. 177) and Børgesen. Therefore, I propose to maintain *Cl. hauckii* Børg. as a form of *Cl. fracta* under the name **Cl. fracta** (Dillw.)

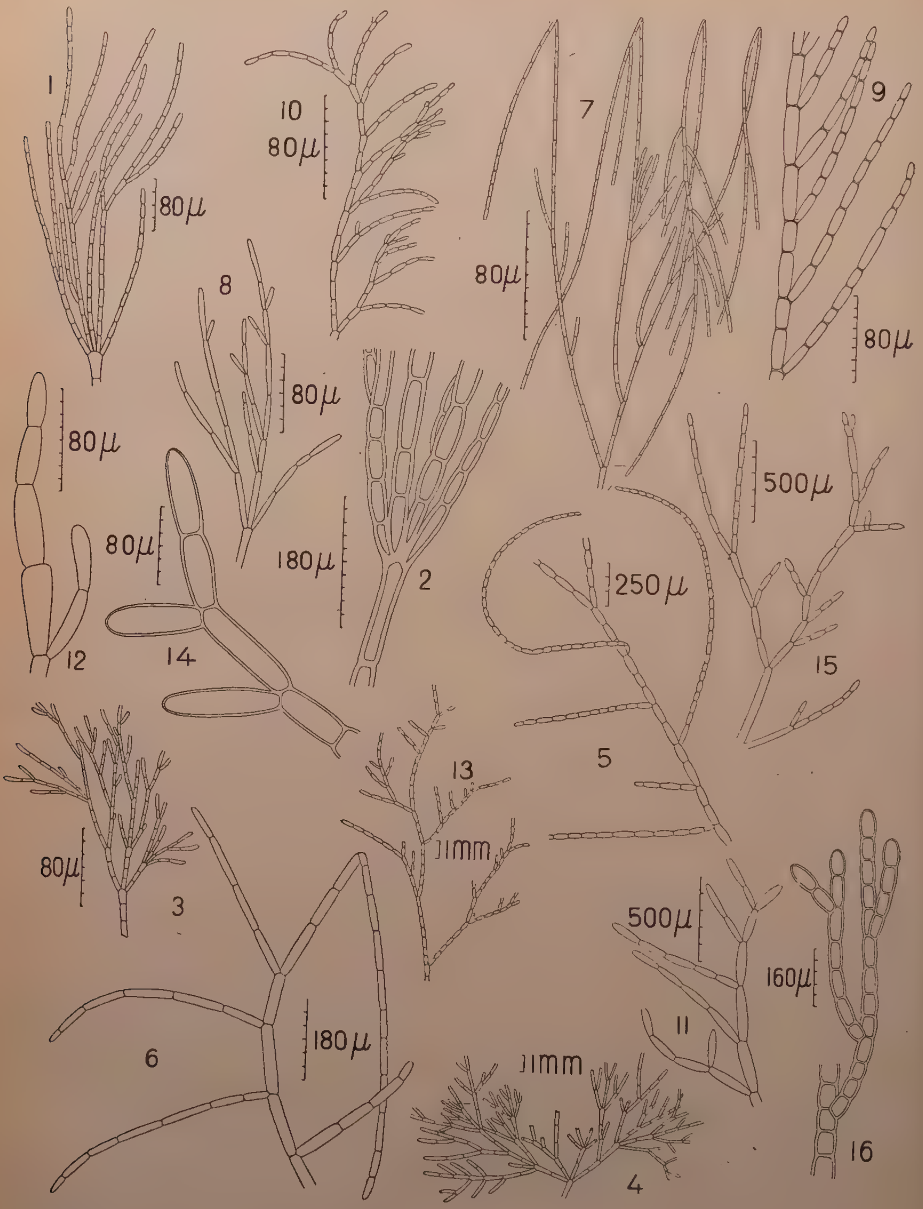

Fig. 1, 2. *Cl. rupestris* (L.) Kütz.; 3. *Cl. penicillata* (Kütz.) var. *lutescens* (Kütz.) Ardiss. f. *longiarticulata* Kütz.; 4. *Cl. fascicularis* (Mert.) Kütz.; 5. *Cl. gracilis* (Griff.) Kütz.; 6. *Cl. fracta* (Dillw.) Kütz. f. *hauckii* (Børg.) Slootweg; 7. *Cl. nitida* Kütz.; 8. *Cl. crystallina* (Roth) Kütz.; 9. *Cl. flexuosa* Harv.; 10. *Cl. refracta* (Roth) Kütz.; 11, 12. *Cl. utriculosa* Kütz.; 13, 14. *Cl. macallana* Harv.; 15. *Cl. hirta* Kütz.; 16. *Cl. arcta* (Dillw.) Kütz.

Kütz. f. **hauckii** (Børg.) Slootweg, nov. comb.; *Cl. fracta* (Dillw.) Kütz. f. *marina* Hauck cannot be maintained as has been pointed out by Brand (p. 177) already.

I might suggest that the differences between *Cl. fracta* and *Cl. fracta* f. *hauckii* are the result of environmental differences, acting, however, not during one generation, but during a number of successive generations.

Forma *hauckii* can be distinguished from f. *typica* by the following features:

1. The relative cell-length is much greater.
2. The ultimate ramuli are longer and scarcer.
3. The evection is sooner completed; in f. *hauckii* we seldom find that the basal cells of the branches are partly grown together.
4. The diameter of the cells of the branches and filaments is somewhat larger.

Part of the material from the Zuiderzee, which was determined by Van Goor as *Cl. fracta* is *Cl. fracta* f. *typica*, the rest is *Cl. fracta* f. *hauckii* and all kinds of intermediate forms.

Key to the species.

1. a. Branches often 4 or more together 2

b. Mostly 2 branches together, sometimes 3 4

2. a. Not much branched, branches long, cells at the foot of the branches mostly somewhat broadened to the top, cells in the ultimate ramuli somewhat shorter than in the branches, more or less thickened; main branches up to 150 μ in diameter, cells 4—10 times as long as broad, ultimate ramuli 50—90 μ in diam., cells 2—6 times as long as broad, dark green. *(fig. 1, 2)*
1. Cl. rupestris (L.) Kütz.

b. Much branched, branches rather short 3

3. a. Lower branches single or in two's, upper branches three or four together, ultimate ramuli single, cell at the foot of a number of branches often much shorter than the lower cells and much broadened towards the top, terminal cells mostly elongated, main branches 100—150 μ in diam., cells 3—8 times as long as broad; ultimate ramuli 45—60 μ in diam., cells 4—10 times as long as broad, terminal cells 10—20 times as long as broad *(fig. 3)*.
2. Cl. penicillata Kütz.
var. **lutescens** (Kütz.) Ardiss. **f. longiarticulata** Kütz.

b. Mostly 4 or more branches in a whorl; often with branches between the whorls; main branches 225 μ in diameter, cells 3—4 times as long as broad, ultimate ramuli 50—90 μ in diam., cells 2—3 times as long as broad. *(fig. 4)*.
3. Cl. fascicularis (Mert.) Kütz.

4. a. Thin, slack, slender, cells mostly long (5—20 times as long as broad), ultimate ramuli up to 60 μ in diam. 5

b. Not so slender 7

5. a. Very graceful, cells sometimes fairly short, ultimate ramuli long and thin (30—60 μ in diameter), cells 3—6 (sometimes 8—10) times as long as broad; main branches 100—140 μ in diam., cells 2—6 times as long as broad. Often specimens were found, of which the ultimate ramuli were 24 μ in diameter *(fig. 5)* . . . . **4. Cl. gracilis** (Griff.) Kütz.

b. Not so slender, attached when young, soon becoming detached; much branched when young, afterwards forming balls consisting of interwoven sparingly branched branches. Main branches stiff, with spreading angularly bent branches, ultimate ramuli few and partly obtuse. Very polymorphous, of variable dimensions; main branches 120—180 μ in diameter, ultimate ramuli 30—60 μ in diam., cells 4—15 (1—3) times as long as broad *(fig. 6)* **5. Cl. fracta** (Dill.) Kütz. f. **hauckii** (Børg.) Slootweg 1).

c. Often fairly branched, very thin, somewhat silky 6

6. a. Ultimate ramuli extremely long (several mm), frequently dichotomous with short ultimate ramuli closely under the apex, branches 20—50 μ in diam., cells 3—10 (terminal cells 14) times as long as broad. Main branches 75—100 μ in diam., cells 3—9 times as long as broad *(fig. 7)* . . . . **6. Cl. nitida** Kütz.

b. Branches long, but not so long as those of *Cl. nitida*, ultimate ramuli short, at more or less regular distances on the branches, branches mostly dichotomous, sometimes trichotomous, very much branched, somewhat silky; main branches 70—130 μ in diam., cells 3—10 times as long as broad, ultimate ramuli 20—40 μ in diam., cells 5—15 times as long as broad *(fig. 8)* **7. Cl. crystallina** (Roth) Kütz.

7. a. There is a more or less distinct difference in relative length between the cells of the branches and those of the ultimate ramuli, plants stiff, very polymorphous, little branched main branches 80—160 μ in diam., cells 3—5 times as long as broad, ultimate ramuli 30—70 μ in diam., cells 1—3 times as long as broad *(fig. 9)* **8. Cl. flexuosa** Harv.

b. No difference in relative cell-length between the cells of the branches and those of the ultimate ramuli 9

8. a. Ultimate ramuli mostly somewhat thinner (25—50 μ) than the branches, the relative cell-length, however, being the same (2—3 times as long as broad), branches sometimes reflexed, apices of ultimate ramuli mostly somewhat obtuse; main branches 60—120 μ (as a rule 80 μ in diam.), stiff. Very variable *(fig. 10)* **9. Cl. refracta** (Roth) Kütz.

b. No distinct difference in length and diam. between the cells of the branches and ultimate ramuli 9

9. a. Fairly branched, top cells much longer than the other cells, branches 70—100 μ in diam., relative cell-length variable (2—8 times as long as broad), cells sometimes broadened towards the top, or club-shaped; top-cells sometimes also club-shaped *(fig. 11, 12)* . . . . **10. Cl. utriculosa** Kütz.

b. Not so much branched, terminal cells not longer than the other cells . . 10

10. a. Branches up to 170 μ in diam., cells 4—5 times as long as broad, filaments and ultimate ramuli 90—110 μ in diam., 2—4 times as long as broad. Cells sometimes club-shaped, or conical, apices always obtuse, branches often partly coalescent *(fig. 13, 14)* . . . . **11. Cl. macallana** Harv.

b. Branches (100—175 μ in diam.) long, ultimate ramuli (40—95 μ in diam.) short. Cells of the filaments 2—4 times as long as broad, of the ultimate ramuli 1—4 times as long as broad, often a little thickened, apices subacute *(fig. 15)* **12. Cl. hirta** Kütz.

c. Algae with rhizoidal branches with club-shaped cells, at the base 75—90 μ, at the top 150—250 μ in diam. Relative cell-length dependent on the age, older cells 1—2 times as long as broad, younger ones (3—4) 8—12 times as long as broad *(fig. 16)* . . . . **13. Cl. arcta** (Dillw.) Kütz.

1. **Cladophora rupestris** (L.) Kütz. — Kützing, Phyc. gen. p. 270; Sp. p. 396; Tab. IV, t. 3; Harvey, t. 180; Hauck p. 452; De Toni p. 328; Hylmö p. 32, t. 3, f. 1; v. Goor p. 128; Hamel p. 19; Lakowitz p. 155; Newton p. 83.

Localities: Dronrijp, IX-1854 n. 114c; Southcoast of Friesland, VII-1854 n. 1146, *Suringar*; Vlieland, V-1851, *Weber—v. Bosse*; Hoorn, IX-1854, *Suringar* n. 114a; Monnikendam, VII-1905, *v. Goor*; Den Helder, VI-1882, *Went*; ibid., VII-1893, *Weevers*; ibid., VIII-1897; ibid. (Wierhoofd), VIII-1899, *Bonnema*; ibid., IV-1916, *Havinga*; ibid., VII-1931 n. 491; ibid., II-1936; ibid., IV-1938, all by *Koster*; Nieuwediep, 1837, *Broers*; Hook of Holland, VII-1947, *Koster* n. 1046; Zandkreek, XI-1843, *Suringar*; Oosterschelde, IX-1841, *Suringar* n. 194; Zierikzee, IV-1939 n. 38, n. 99 en

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1) For the differences between *Cl. fracta* f. *typica* and *Cl. fracta* f. *hauckii* see above.

n. 114; Schouwen, IV-1939 n. 34 en n. 44, both by *Vervoort*; Vere, X-1940 n. 25 en n. 26; Kanaal door Zuid-Beveland, XII-1941 n. 305; Walcheren (Arnemuidens Kanaal) VI-1941 n. 283; ibid., XII-1943 n. 467; Kortgene, II-1941 n. 14; all by *Brakman*; Woensdrecht, XI-1943, *Maas Geesteranus* n. 2890; Yerseke, IX-1947, *Korringa*.

2. **Cladophora penicillata** Kütz. var. **lutescens** (Kütz.) Ardiss. f. **longiarticulata** Kütz. — Kützing, Sp. p. 403; De Toni p. 316; v. Goor p. 120.

Localities: Coast of Friesland, 1932, *Koopmans*; Den Helder (Zuidwal), VII-1919; ibid. (Vangdam), VIII-1919; both by *v. Goor*.

3. **Cladophora fascicularis** (Mert.) Kütz. — Kützing, Phyc. gen. p. 268; Sp. p. 393; De Toni p. 316.

Locality: Oosterschelde, VII-1846, *v. d. Bosch* n. 231.

4. **Cladophora gracilis** (Griff.) Kütz. — Kützing, Phyc. germ. p. 215; Sp. p. 403; Tab. IV, t. 23; Harvey, t. 18; Hauck p. 457 fig. 195; De Toni p. 322; Hylmö (1916) p. 33, t. 3, fig. 5; v. Goor p. 124; Hamel p. 21 fig. 16; Lakowitz p. 159 fig. 223; Newton p. 85.

Localities: Southcoast of Friesland, VII-1854, *Suringar* n. 118; Terschelling, *de Jong v. Rodenburg* n. R 7 en n. R 18; Nieuwediep, VI-1886 n. 182; ibid., VIII-1887, n. 498, both by *Weber—v. Bosse*; ibid., VIII-1891, *Moll*; ibid., VII-1937, *Koster* n. 355; ibid. (Zuidwal), VI-1916, *v. Goor*; Den Helder, 1893, *Weber*; Goes (Harbour), IX-1843 (2 ×); ibid., IV-1845 n. 176, both by *v. d. Bosch*; Oosterschelde, *Suringar*.

5. **Cladophora fracta** (Dillw.) Kütz. f. **typica** — Kützing, Phyc. gen. p. 263; Sp. p. 288; Tab. IV, t. 50; Harvey t. 294; De Toni p. 288; Hamel p. 14.

Localities: Nieuwediep, VII-1887, *Weber—v. Bosse* n. 475; Hoorn IX-1854, *Suringar* n. 115; Kampen, Zuiderzee n. A 17; Goes, VI-1846 n. 139 en n. 309; all by *v. d. Bosch*; Zeeburg, IV-1885, *Weber—v. Bosse* n. 278.

Cladophora fracta (Dillw.) Kütz. f. **hauckii** (Børg.) Slootweg — *Cl. fracta* f. *marina* Hauck p. 461; v. Goor p. 113; Lakowitz p. 162; Newton p. 86. — *Cl. heteronema* Brand p. 177 (non (Ag.) Kütz.). — *Cl. hauckii* Børgesen p. 18.

Localities: Coast of Friesland, XI-1918, *v. Goor*; Zuiderzee, *Rijns* (Herb. Nijland); and a further number of samples collected in the course of the Zuiderzee expedition (1905) and determined by *v. Goor* as *Cl. fracta*; Nieuwediep, VII-1887, *Weber—v. Bosse*, n. 496; W. Terschelling, VII-1937, *Koster* n. 166; Den Helder (Balgzand), *Weber*; Wieringen, VIII-1916, *v. Goor*; Goes (Harbour) VI-1846 n. 31, n. 326, n. 333; ibid., V-1841; both by *v. d. Bosch*, ibid., IX-1942, *Brakman* n. 383; Zandkreek, VI-1846 n. 312 en n. 313; Oosterschelde, VI-1846 n. 342; both by *v. d. Bosch*; Arnekanaal, VI-1941; ibid., X-1942; Sloedam, IX-1942 n. 361; Noordelijk Sloe VIII-1940 n. 20 en n. 22; Kanaal door Walcheren (Vere), VIII-1942 n. 359; Arnebrug IX-1940 n. 23 en n. 374; Middelburg, VIII-1940 n. 21; Kleverskerke, VII-1943 n. 405; all by *Brakman*; Schouwen, IV-1939 n. 8; Haamstede, VII-1943; both by *Vervoort*.

6. **Cladophora nitida** Kütz. — Kützing, Phyc. gen. p. 269; Sp. p. 404; Tab. IV, t. 28; De Toni p. 320; v. Goor p. 123; Newton p. 84.

Localities: Medemblik, VIII-1905; Nieuwediep, IX-1885, *Heinsius*; den Helder (Wierbalg), VI-1917; ibid. (Zuidwal), VII-1917; both by *v. Goor*; Goes, *v. d. Bosch*.

7. **Cladophora crystallina** (Roth) Kütz. — Kützing, Phyc. germ. p. 213; Sp. p. 400; Tab. IV, t. 19; Hauck p. 459; De Toni p. 318; Hylmö p. 35, t. 3, f. 7; v. Goor p. 121; Hamel p. 12; Newton p. 85.

Localities: Nieuwediep, VII-1887, *Weber—v. Bosse* n. 544; den Helder (Zuidwal), VII-1916; ibid., VII-1920; both by *v. Goor*; Zeeburg, VII-1885, *Weber—v. Bosse* n. 280 en n. 499a; Rotterdam, V-1851, *Oudemans*; Goes (Harbour) IX-1841 n. 34; ibid., IX-1843; both by *v. d. Bosch*.

8. **Cladophora flexuosa** Harv. — Harvey t. 353; Hauck p. 456; De Toni p. 311; v. Goor p. 118; Hamel p. 20; Newton p. 85.

Localities: Den Helder, VII-1931, *Koster* n. 490; Nieuwediep, VI-1886, *Weber—v. Bosse* n. 166 en n. 445; ibid., VII-1939, *Koster* n. 356 en n. 362; Zandvoort, I-1852, *Buse*; Zeeburg, II-1884, *Weber—v. Bosse* n. 81; Elburg, VII-1859, *Spree*; Goes (Harbour), XI-1841, n. 36; Zandkreek, IX-1841 n. 37; ibid., VIII-1844; all by *v. d. Bosch*; Oosterschelde, *Suringar* n. 13; Den Helder (Zuidwal), V-1919; Schokland, VI-1921; Wervershoof, IX-1921; all by *v. Goor*; Nieuwediep, IX-1885, *Heinsius*.

9. **Cladophora refracta** (Roth) Kütz. — Kützing Phyc. gen. 267; Harvey p. 24; Kützing Sp. p. 398; Tab. IV, t. 10; De Toni p. 324; Lakowitz p. 158; Newton p. 85.

Localities: Stavoren, X-1921; Zeeburg, VII-1921, both by *v. Goor*; Hook of Holland, VII-1947, *Koster* n. 1050; Goes (Harbour), VI-1846 n. 333; XI-1847 n. 404; both by *v. d. Bosch*; ibid., I-1846, *Suringar*; Zandkreek, VI-1846, *v. d. Bosch*; ibid., V-1847, *Suringar* n. 1072.

10. **Cladophora utriculosa** Kütz. — Kützing Phyc. gen. p. 269; Sp. p. 393; Tab. III, t. 94; Hauck p. 454 partim.; De Toni p. 312; v. Goor p. 119; Hamel p. 1; Lakowitz p. 156; Newton p. 83.

Localities: Lemmer (Westpier), IX-1921; Nieuwediep; Den Helder (Vangdam); VII-1915; ibid. (Zuidwal), VII-1917; ibid. (ibid.), VII-1919; all by *v. Goor*; Vlieland, VIII-1947, *v. Veen*; Woensdrecht, *Sloff*; Zandkreek, IX-1842, *Suringar*; Oosterschelde, IX-1841 n. 36 en n. 37; ibid., VIII-1842; both by *v. d. Bosch*.

11. **Cladophora macallana** Harv. — Harvey t. 84; Kützing Sp. p. 392; Tab. III, t. 86; De Toni p. 313; v. Goor p. 120; Hamel p. 15; Newton p. 82.

Locality: Southcoast of Friesland, VII-1854, *Suringar* n. 113.

12. **Cladophora hirta** Kütz. — Kützing Phyc. germ. p. 208; Sp. p. 395; Tab. IV, t. 1; Hauck p. 456; De Toni p. 329; v. Goor p. 129; Hamel p. 19; Lakowitz p. 158; Newton p. 83.

Localities: Terschelling (Riepel); Monnikendam, VII-1905; both by *v. Goor*; Den Helder, VII-1939, *Koster* n. 489.

13. **Cladophora arcta** (Dillw.) Kütz. — Kützing Phyc. germ. p. 263; Sp. p. 417; Harvey t. 135; Hauck p. 445; De Toni p. 335; v. Goor p. 129; Hamel p. 31.

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A NEW SYSTEM OF THE CORMOPHYTA

by

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> The gaps in the fossil record are many, but there is optimistic hope for the future.
> (W. C. Darrah, 1939).

Some time ago I proposed elsewhere (1) a new system of the *Cormophyta*. Since the periodical, whose hospitality was my privilege, may not reach many taxonomists who still may be expected to be interested in the proposal, I deem it justified to briefly review the results at which I arrived in the present journal; and this will give me an opportunity to explain one or two points of a nomenclatural nature which, it seems to me, were perhaps somewhat insufficiently elucidated in the paper quoted. As a matter of course, for details as well as for the full argumentation of my views I have to refer to that publication.

The (here slightly emendated) system proposed is the following (anatomical characters omitted):

CORMOPHYTA.

Ground-plan — green plants with alternation of thallose, probably dichotomous generations, at least sporophyte with aerial sporangia in the ultimate lobes, isosporous.

Tendencies — strong reduction of gametophyte; development of aerial independent sporophyte in which the dichotomous ramification is gradually replaced by other branching types; development of vascular tissue (stele), of photosynthetic surface increase (enation leaves, telome leaves), of improved sporangium protection (sporangial connections), of heterospory and of woody, leafy stems (cormus), in which gradually connections are developed between branching and phyllotaxy (vegetative connections).

I. EOCORMOPHYTA — stachyosporous, without leaves or microphyllous, vegetative connections none; sporangia terminal and orthotropous or with primitive axillary connection; isosporous (or incidentically heterosporous?).

A. E. gametophytea — gametophyte dominating, with or without leaves; sporophyte (hemi)parasitic on gametophyte, not branched, leafless, isosporous. **1. Bryopsida**

a. *Hepaticae*; b. *Musci*.

B. E. sporophytea — sporophyte dominating and physiologically independent (always?), branching primarily dichotomous, persistent even in main branches or at least in younger ones; no leaves or microphyllous (enation leaves?); sporangial connections in c only; isosporous (incidentical heterospory in b?). **2. Psilopsida**

a. *Nematophytales?*; b. *Psilophytales*; c. *Psilotales*.

II. PALAEOCORMOPHYTA — stachyosporous or phyllosporous; sporophyte dominating, physiologically independent, as is gametophyte except if seeds are developed, in which case gametophyte is parasitic on sporophyte; vegetative connections none or interfoliar or ± axillary.

- A. P. microphylla — stachyosporous and microphyllous; sporangia free or with various connections with sterile organs.
  - 1. branching primarily dichotomous, often persistent even in main branches; no vegetative connections except by (? pseudo)angular leaves; enation leaves?; ligule incidentally extant (not in a, c and d); sporangia single, fundamentally ana(epi)tropous?; sporangial connections axillary (stegophylls); isosporous or heterosporous, some with seeds (Lepidospermales). . **3. Lycopsida**

    a. *Protolycopsida*; b. *Lepidophytales* and *Lepidospermales*; c. *Pleuromeiales*; d. *Lycopodiales*; e. *Selaginellales*; f. *Isoëtales*.
  - 2. branching in older groups still dichotomous but main branching very soon of the monopodial type, the lateral organs in whorls inducing an early and pronounced articulation; telome leaves relatively small and soon tending to strong reduction, ultimately to monotelomic microphylls; vegetative connections none or, in the most recent group (f), interfoliar; sporangia anatropous, mostly in dichotomous groups (epi- and apotropous), more rarely single and then mostly epitropous, rarely apotropous; sporangial connections, if any, axillary (stegophylls), mostly to next lower leaf whorl and then sporangia epitropous, rarely to next upper one and then sporangia apotropous; isosporous, rarely heterosporous. . . . . **4. Sphenopsida**

    a. *Protosphenopsida*; b. *Pseudoborniales*; c. *Sphenophyllales*; d. *Cheirostrobales*; e. *Tristachyales*; f. *Equisetales*.
- B. P. macrophylla — originally stachyosporous, but very soon phyllosporous by excessive aggregation of sterile telomes into telome leaves; dichotomous branching persistent, particularly in the younger branchings (venation), eventually blurred by younger processes (anastomosing), main one mostly sympodial or monopodial; vegetative connections by angular leaves at dichotomies, gradually developing into an axillary connection; megaphyllous, reductions slight or none; sporangia originally terminal but soon marginal and ultimately laminal (upper or lower side of leaf), fundamentally orthotropous, in sori, often protected by indusia, synangial aggregation (Fil. eusp.) or infolding of leaf parts (b ♂ and ♀; d ♀); isosporous or heterosporous, some with seeds in which special protective organs (integument, cupula) develop; eusporophylls (all?). **5. Pteropsida**

  a. *Filicales*: Protofilices (= Primofilices: Cladoxylales, Coenopteridales, Fil. eusporangiatae, Fil. protoleptosporangiatae, Fil. leptosporangiatae; b. *Hydropteridales*; c. *Noeggerathiales*; d. *Caytoniales* (stachyosporous?; megasporangia "angiospermous"); e. *Pteridospermales*.

III. MESOCORMOPHYTA — sporophyte dominating, wood with tracheids only; gametophyte parasitic; vegetative connection approaching a strictly axillary stage; heterosporous megasporangia in integument(s), otherwise naked, forming seeds, orthotropous or slightly anatropous.

- A. M. macrophylla — mainly phyllosporous, megaphyllous; sporangia of the Pteropsida type. . . . . **6. Cycadopsida**

  a. *Cycadales*; b. *Nilssoniales?*; c. *Bennettitales* (♀ stachyosporous).
- B. M. microphylla — mainly stachyosporous, tending to leaf reduction and microphylly or with cladosporophylls; sporangial connections none or axillary (stegophylls); microsporangia anatropous. . . . . . **7. Coniferopsida**

  a. *Ginkgoales*; b. *Cordaitales*; c. *Coniferales* (♂ phyllosporous exc. *Taxus*?; ♀ Pinaceae and Araucariaceae secondarily phyllosporous; Cheirolepidaceae ditto, with "angiospermous" megasporangia).

IV. NEOCORMOPHYTA — sporophyte dominating, gametophyte parasitic; wood with tracheids or wood vessels or both; vegetative connections strictly axillary; heterosporous; megasporangia tending to acquire additional protection (angiospermy); seeds; growing tendency to develop flowers (synstegophylls).

- A. Stachyosporous; wood with tracheids or wood vessels or both; megasporangia in integuments, otherwise naked or, if covered by sterile organs then the plants microphyllous and with decussate or whorled phyllotaxy; sporangia orthotropous. **8. Protangiospermae**

a. *Chlamydospermales* (*Gnetales*); b. *Verticillatae* (*Casuarina*).

B. Stachyosporous or phyllosporous; wood vessels prevailing, tracheids only rare; megasporangium in integument(s) and, in addition, more or less perfectly covered by or enclosed in sterile organs (angiospermy); sporangia ortho- or anatropous. . . . . **9. Angiospermae**

a. A. stachyosporae — stachyosporous; megasporangia protected by sterile organs (*e.g.* sterilised microsporangiophores; pseudocarpels); traces of ancient dichotomies mainly in (♂) reproductive parts; ± *Monochlamydeae*, perhaps also some Monocotyledons and Sympetalae.

b. A. phyllosporae — phyllosporous; megasporangia enclosed in infolded leaves (eucarpels); traces of ancient dichotomies mainly in vegetative parts (venation); ± *Polycarpicae* and derivatives.

For a preliminary understanding of this system, a brief explanation of certain terms will be indispensable to those who are not able to consult my earlier paper.

Stachyospory I call the condition in plants, in which the sporangia, whether iso- or micro- and megasporangia, are essentially terminal on entirely (or prevailingly) fertile telomes; the latter being the endings of a branch-system, which was dichotomous (isotomous) originally but which subsequently developed into sympodial and monopodial systems in their older parts; thence in many but the most primitive types these sporangiophores were inserted on a (relative) main axis (in the most primitive groups, like the *Psilophytales*, they are [relative] main axes).

In stachyosporous groups traces of ancient dichotomies are particularly found in (♂) sporangiophores (stamens).

There seems to be a general tendency, even in the vegetative parts to reduce the leaf surface (microphylly).

Sporangia are, therefore, in this type of plants, not borne on leaves so that there are no sporophylls, but they may, particularly in the ♀ sex, and in various ways and degrees, find protection not only from integuments, etc. but from sterile organs (stegophylls) which may subtend them, to which they may become more or less closely (axillarily) connected or which may cover them in some way (e. g. in the Angiosperms as pseudocarpels). In a few cases (certain Conifers such as *Podocarpus* and the *Pinaceae* and *Araucariaceae*) the megasporangia are inserted on a secondary leaf structure or phyllocladium (cladosporophyll).

Stachyosporous are the *Bryopsida*, the *Psilopsida*, the *Lycopsida*, the *Sphenopsida*, the ♀ *Bennettitales*, the *Coniferopsida* (except the secondary phyllospory in the cladosporophylls and except the ♂ Conifers which are mainly phyllosporous), the *Protangiospermae* and the *Angiospermae stachyosporae* (perhaps ♂ sometimes phyllosporous?).

Phyllospory I have proposed to call the condition in which sporangia are essentially 'drowned' in an excess of sterile telomes, i. e. on a leaf (eusporophyll).

In phyllosporous groups traces of ancient dichotomies are particularly found in the vegetative parts (venation).

There is a general tendency to develop large leaves (megaphylly).

Protection of sporangia is procured by leaf structures (e. g. the fern indusium), of megasporangia by various structures such as integuments, cupulae, etc., and additionally by infolding of the leaf or of parts thereof (*Hydropterides, Caytoniales, Angiospermae phyllosporae* with eucarpels).

Phyllosporous are the *Pteropsida* (except the *Caytoniales*?), the *Cycadopsida* (except the ♀ *Bennettitales*), the ♂ *Coniferae* (except *Taxus*) and the *Angiospermae phyllosporae.*

There seems to be some preference for the development of phyllospory in the male sex (*Bennettitales, Coniferae, Cordaitales*?). Whether this applies also to the Angiosperms is still unknown.

The main point in this system is that the class of the Angiosperms has lost its position as a starting point for morphological interpretations of all other *Cormophyta.* At the beginning of the present century Angiosperm morphology grew more and more — sit venia verbo — constipated, and the mild laxative, gently administered by palaeobotany, has now led to a condition in which everything is loosened and, at a still increasing rate, on the move again, presumably for a long period of interesting investigation in a hitherto well-nigh unexplored domain.

In order to facilitate a survey of the principal alterations which seemed an imperative consequence of our changed morphological viewpoint, the following statement may serve as an introduction to some conclusive remarks. For comparison I chose Wettstein's system of 1935 (see page 286):

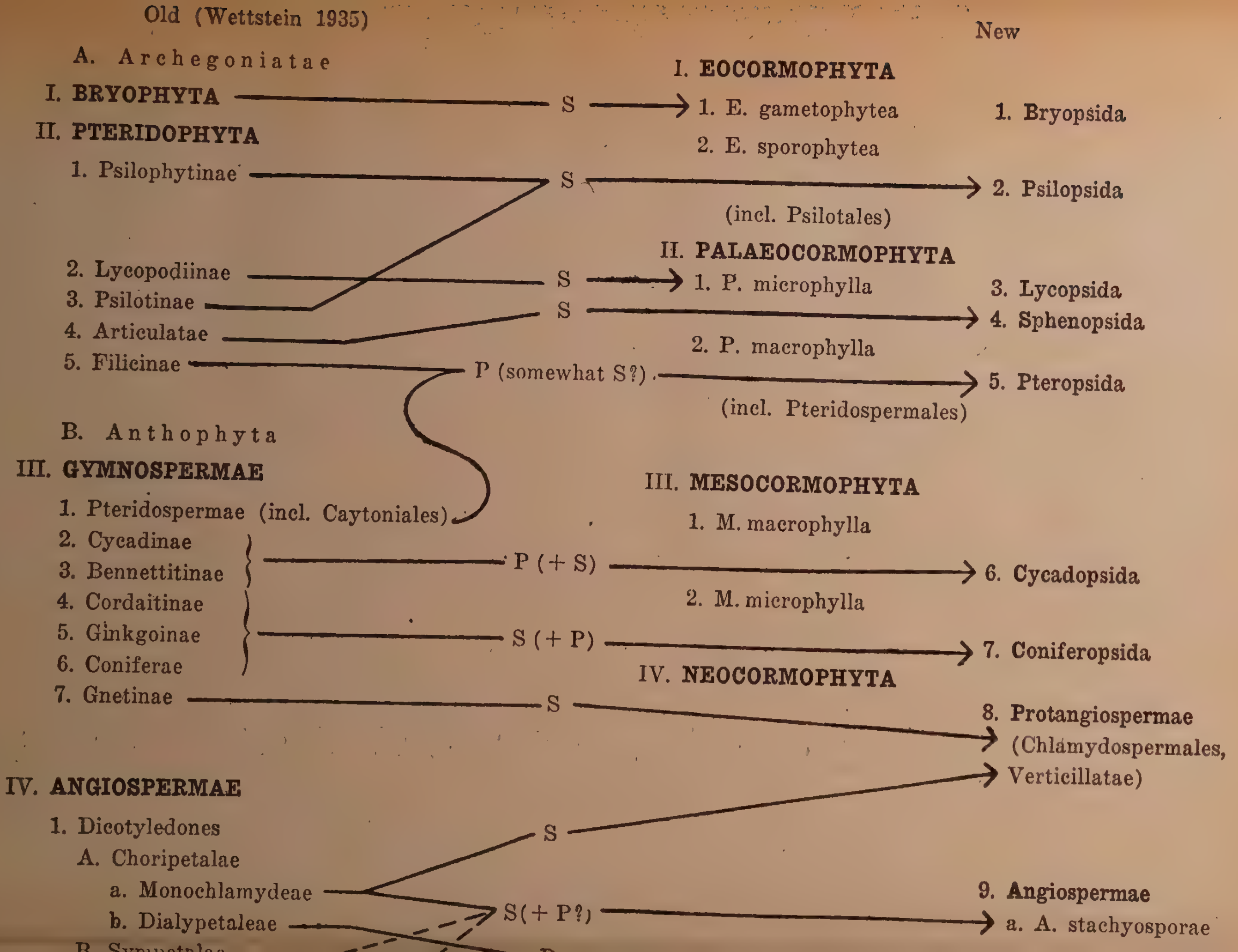
The new system is little else than a rearrangement of the well-known natural groups, of which only a few have been subject to slight but essential modifications. As appears from the above statement the groups 1, 3, 4, 6 and 7 have remained unaltered.

Altered are the groups:

2. *Psilopsida,* in as far the *Psilotales* are considered the recent plants which seem nearest to the ancient *Psilophytales*; unfortunately there are no fossil connections known thusfar.

5. *Pteropsida,* in which the Pteridosperms have been inserted. Typologically speaking, the latter clearly belong to the former (which I take in the limited sense as comprising the ferns and their near allies only; not, as was done by Jeffrey, Zimmermann and Eames, comprising all Cormophyta from the ferns upwards). That the Pteridosperms have sometimes been included in the '*Gymnospermae*' is merely a consequence of the old Angiosperm-centred morphology which convulsively clung to the concept of a 'sporophyll' in all groups; it was also a consequence of the fact that the Pteridosperms developed seeds and wood; this, however, was also the case in the *Lepidospermales* and seeds possibly also in the *Psilophytales.*

8. *Protangiospermae,* a group created by Engler for any hypothetical Angiosperm ancestors but taken over by me without any phylogenetical meaning to comprise some groups of plants which in some way seem to be intermediate between the *Mesocormophyta* and the *Angiospermae.* In this group I have placed the *Chlamydospermae (Gnetales, Gnetinae)* and *Casuarina (Verticillatae),* both of which have always been groups of obscure relationships to other plants whilst showing indubitable traces of interrelationship, i.e. between *Ephedra* and *Casuarina* (decussate phyllo-


Old (Wettstein 1935)
New
A. Archegoniatae
I. BRYOPHYTA
II. PTERIDOPHYTA
1. Psilophytinae
2. Lycopodiinae
3. Psilotinae
4. Articulatae
5. Filicinae
B. Anthophyta
III. GYMNOSPERMAE
1. Pteridospermae (incl. Caytoniales)
2. Cycadinae
3. Bennettitinae
4. Cordaitinae
5. Ginkgoinae
6. Coniferae
7. Gnetinae
IV. ANGIOSPERMAE
1. Dicotyledones
A. Choripetalae
a. Monochlamydeae
b. Dialypetaleae
S
S
S
S
P (somewhat S?)
P (+ S)
S (+ P)
S
S
S(+ P?)
I. EOCORMOPHYTA
1. E. gametophytea
2. E. sporophytea
(incl. Psilotales)
II. PALAEOCORMOPHYTA
1. P. microphylla
2. P. macrophylla
(incl. Pteridospermales)
III. MESOCORMOPHYTA
1. M. macrophylla
2. M. microphylla
IV. NEOCORMOPHYTA
1. Bryopsida
2. Psilopsida
3. Lycopsida
4. Sphenopsida
5. Pteropsida
6. Cycadopsida
7. Coniferopsida
8. Protangiospermae
(Chlamydospermales,
Verticillatae)
9. Angiospermae
a. A. stachyosporae

taxy, microphylly, double fertilisation). In fact, *Casuarina* seems, typologically speaking, more closely connected to *Ephedra* than to any living monochlamydeous plant, though the decussate 'perianth' of the Chlamydosperms may bear some relation to the two pseudocarpels of many of the more primitive *Monochlamydeae.*

I originally added the '*Exocarpales*', but the insertion of that group is still so much uncertain that we should rather wait for the further development of this interesting case (2).

9. *Angiospermae*, which have kept their old delimitation except insofar as *Casuarina* (and perhaps *Exocarpus*) are concerned.

The main subdivision is both chronological, insofar as the four main groups correspond to the four main palaeobotanical era's (*Eophyticum* having been added by me to indicate the period of the monocracy of the Thallophytes; it ended at the rise of the — probably still unknown — oldest land plants); and evolutionary in that the sequence refers to an increasing differentiation in the sense of the telome theory. Important factors are furthermore micro- and megaphylly and particularly, stachyo- and phyllospory, which have been explained above.

As to the nomenclature I may add the following remarks to those mentioned in my earlier paper.

Obsolete are a. o. the names:

a. *Gymnospermae* — which does not cover a typologically natural group, not only because it comprises various basic types (groundplans) but since the concept of the sporophyll has fundamentally altered and, moreover, since the boundary towards the Angiosperms has grown more and more vague. In several *Monochlamydeae* (*Myrica*, etc.) the ovary is hardly closed, particularly in a young state. On the other hand "angiospermy", i. e. the state of coveredness (in some way or other) of the 'ovulum' (megasporangium), is found in the coniferous *Cheirolepidaceae*, in the *Caytoniales*, in the *Hydropteridales* and even more or less in the *Lepidospermales.* Even within the Angiosperms there are two fundamentally different types of angiospermy: the infolding of the leaf in the *Phyllosporae*; and the covering by stegophylls in the *Stachyosporae.*

b. *Spermatophyta* — which does not cover a natural group since seeds are developed in various non-related groups.

c. *Anthophyta* — which alludes to a structure, the flower, of which nobody will be able to give a more or less satisfactory definition, even if we agree to restrict this term to fertile shoots with "synstegophylls" ¹) (perianth) which are, perhaps, found in a primitive state in the Protangiosperms and which, obviously, only reach their full development in the Angiosperms. As a matter of course, the organogenetic (evolutionary) development of the flower has been a very gradual one and even if we were able, at present, to describe its rise, nobody would be in a position to mark any particular stage at which the concept would start to be applicable.

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¹) This process is repeated "on a higher level" in the flower-imitating inflorescences of *Compositae, Umbelliferae, Euphorbia, Craterogyne,* etc.

d. *Pteridophyta* — which, in Wettstein's delimitation, does not cover a natural group. In addition to this, the following considerations seem to deserve some attention. The reason why the suffix *-opsida* has been chosen for seven out of the nine natural groups, is that I agree with Wettstein to retain the suffix *-phyta* for the main phyla, of which the whole of the *Cormophyta* constitutes a single one. The consequence was that no group of lower rank could be maintained with the same ending. Therefore, beside *Spermatophyta* and *Antophyta* which had become useless on other grounds, *Pteridophyta* had to be abandoned. Now Jeffrey in 1899 (3) introduced the terms *Lycopsida* and *Pteropsida* though both in a delimitation somewhat different from ours. In 1909 Scott (4) followed with the *Sphenopsida* and in 1936 Eames (5) with the *Psilopsida*. I deemed it only logical to complete the series, as far as this seemed desirable, and this is why I proposed the names *Bryopsida*, *Cycadopsida* and *Coniferopsida*.

Psilophyta which, accordingly, had to be dropped as well, could easily and logically be changed into *Psilophytales*, as the name of an order. *Thallophyta* has already to be abandoned as not being a phylum at all.

In *Eocormophyta gametophytea* and *E. sporophytea*, the second names are taken from Lignier (1908) who introduced them to cover the *Bryopsida* and the *Lycopsida* respectively (6).

I have to add here, that Mr W. H. Camp of the New York Botanical Garden in a recent letter kindly pointed out that the name '*Psilopsida*' was not coined — as I presumed in my previous paper — by Darrah but by Eames [1]), on his instigation. The name was privately used since 1933 and was first published in Eames (5, pp. 114, 330, 401 ss.). In this book, which unfortunately escaped my attention, much the same main classification of the lower Cormophytes was proposed as that used by me, with the exception that the *Bryopsida* are excluded from the '*Tracheophyta*' or vascular plants and that the *Pteropsida* comprise all groups from the Ferns onward. Gymnosperms and Angiosperms are not considered in it.

Another paper previously unknown to me, to which my attention was kindly drawn by Dr J. G. B. Beumée of the Wageningen Agricultural College, is a detailed study by H. Hallier (8), preceded by a short preliminary note (7) in the same year (1902), containing the conclusions of the larger paper. Though, naturally, bearing numerous traces of the Haeckelian way of reasoning — Hallier was one of Haeckel's devoted pupils and this paper is gratefully dedicated to the Master — it contains some remarkable conclusions. Though sometimes inclined to allow his imagination to run away with him, Hallier would, on the basis of his intimate knowledge of higher plants, occasionally arrive at clever concepts. The above-mentioned paper certainly comprises a number of conclusions which seem either too far-fetched or old-fashioned and untenable in the light of our present knowledge. But it is certainly memorable what an author of 1902, though admittedly under the influence of Potonié's publications, said about leaf and axis of the higher Cormophytes (Conclusions 11 and 12):

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[1]) Newman already mentioned this correctly but unfortunately this was overlooked by me.

"11. Das Laubblatt der höheren Achsenpflanzen ist ein Kurztrieb, ein Parasynthallium, d.h. ein durch Uebergipfelung eines Gabelastes durch seinen Schwesterast zur Seite geworfenes und abgegliedertes, flächenförmiges, dem Synklonium von Florideen vergleichbares System kongenital mit einander verschmolzener Zweige des dichotomen Marchantiaceenthallus. Auch das kleinste Aederchen entspricht dem Mittelnerven eines Abschittes des Hymenophyllaceen-wedels und des Marchantiaceen-thallus.

12. Auch die Achse der höheren Achsenpflanzen ist ein derartiges Synthallium ......" (the rest is irrelevant in this connection, as it deals with the now abandoned pericaulome-theory).

In these lines Hallier — for the first time I think — stipulates that Potonié's concept which had always been rather vague about the Angiosperms, is applicable to that group as well. Both Potonié and Hallier, however, are spell-bound by the pericaulome-theory.

Another point which struck me was that (Concl. 17) the *Gnetales* were considered related to the (*Loranthaceae* and the) *Santalaceae* and *Ephedra* to the 'Hamamelidaceengattungen [1]' *Casuarina* (and *Myrothamnus*).

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[1] On p. 10 he speaks of "Amentaceengattungen".

TRACES OF ANCIENT DICHOTOMIES IN ANGIOSPERMS

(A contribution to our Knowledge of Phyllospory and Stachyospory)

by

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Introduction.

It is a generally accepted concept nowadays that dichotomy is the most primitive type of ramification in land plants. Recently Lam (1948) briefly reviewed the literature of this subject in the light of the telome theory. He recalled that the dichotomies of fern leaves are to be regarded as homologous to the dichotomies of stems in more primitive plants and enumerated a number of more or less haphazardly collected cases in higher plants, of which the most probable interpretation is that they are traces of such ancient dichotomies, betraying their original relation to a branch system.

In his paper, Lam discriminated between such traces in vegetative and in reproductive parts and he arrived at the provisional conclusion that traces of ancient dichotomies in the vegetative parts should particularly occur in what he termed the 'phyllosporous' plants, and that those of the reproductive parts are particularly found in the 'stachysporous' groups.

At his instigation I made an attempt to collect some more data in this respect, especially regarding the leaves, but also the perianth and the reproductive organs of the Angiosperms, a subject which hitherto seems to have practically been given no attention. Readily following this suggestion I looked first of all through my own and another private collection of dried plants from the Netherlands, together containing some 3000—4000 specimens in which all families of some importance are well represented. For the families wanting in our flora, I based my investigations both on living material in the Leiden Botanic Garden and on dried material preserved in the 'Rijksherbarium'. In addition, I looked through the complete Engler and Prantl, "Die Natürlichen Pflanzenfamilien".

Yet, though no important group of Angiosperms is likely to have escaped my attention, my work does by no means pretend to be complete or exhaustive. If, despite this, the number of cases mentioned underneath is comparatively small, this should be attributed to two causes; the first is that I mainly paid attention to leaf venation and that only distinct dichotomies of the stronger nerves were given attention; and the second is that only a very small portion of the numerous genera which were looked over, provided me with positive results, which intimates that dichotomy remains a rare phenomenon in the Angiosperms.

Axes.

Regarding traces of dichotomies in main or lateral axes, stems, rhizomes and roots, I have found little in addition to what was mentioned already by Lam. I may only add the following cases.

Next to the dichotomous rootlets in Conifera which are inhabited by a mycorrhiza fungus, I found the same phenomenon in the cycadaceous *Dioon edule* (fig. 1) and Engler and Prantl mention it in *Encephalartos hildebrandti.* It is stated by them that these rootlets are invariably inhabited by a fungus and by endophytic blue-green algae, which are not found in normal, i. e. non-dichotomous rootlets. The dichotomous ones develop near the soil surface; they are negatively geotropic and sometimes protrude into the air.

Analogous cases are found in some saprophytic *Orchidaceae,* e. g. *Epipogon* (cf. Schröter, 1904, pl. 19, fig. 5) and *Coralliorrhiza* (cf. Wettstein, 1935, fig. 689), and *Burmanniaceae,* viz. *Sarcosiphon episcopalis* (fig. 2). No doubt similar structures are to be expected in other saprophytical Angiosperms whose roots (or rhizomes) are inhabited by a mycorrhiza fungus.

As far as stem dichotomies in Angiosperms are concerned I can only add to previously given instances that Troll (1937) cites ¹) dichotomy in the rhizome of *Nuphar* and that Velenovsky (1913) stated dichotomy, accompanied by an angular leaf, in the stem of the amaryllidaceous *Alstroemeria brasiliensis.*

It may be recalled here that stem dichotomies, mostly (always?) with angular leaves, in the Angiosperms thusfar are only known in the Monocotyledones (*Palmae, Amaryllidaceae*) and the *Nymphaeaceae.* In some cases they are quite normal, in others however (*Cocos, Arenga*) they seem to develop as a consequence of some damage inflicted upon the growing point.

Leaves.

In a fern leaf with open venation we regard the nerves as remnants of an ancient ramification system. In the Ferns with closed venation and in the Angiosperms, secondary connections between the nerves darken the picture. However, traces of the original ramification system remain visible, especially in the stronger nerves. Some of these ramifications are from our present point of view traces of ancient dichotomies.

A remarkable fact in the Angiosperms is that the aquatic life is not only accompanied by a reduction of the number of weaker nerves, but that often the leaves are also reduced to the main venation or nearly so. In the ramification of the aquatic leaves we find both splendid dichotomies and monopodial ramification.

The following cases of dichotomy have come to my knowledge; in my enumeration I followed the system given by Wettstein (1935).

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¹) The original publication (Glück, 1924) was unavailable to me.

DICOTYLEDONEAE.

Monochlamydeae.

In the greater part of this group the leaf venation is of the advanced monopodial (pinnate) type, without any traces of dichotomy.

An exception, however, is formed by the *Proteaceae* in which the leaves of many genera (*Simsia*; *Grevillea*; *Hakea*, figs. 3—4) show segmentations and (or) venations of a primitive type, with many apparent dichotomies. Particularly interesting in this respect is the leaf of *Franklandia fucifolia* (fig. 5) which is up to six times dichotomously divided and forms a splendid example of what Troll (1937) calls cruciate dichotomy. This leaf closely resembles the branching system of *Psilotum* and the like.

Some weak traces of dichotomy are found in the nerves of *Chenopodiaceae* and *Polygonaceae*, e. g. in those of *Polygonum convolvulus* (fig. 6).

No distinct traces of dichotomies were found in the *Euphorbiaceae*, but very neat ones in *Buxus* (fig. 7), however, with many transverse connections.

Dialypetalae.

Numerous beautiful traces of dichotomy are found in the leaf venation of the *Polycarpicae*.

Ranunculaceae — *Batrachium* (figs. 8—9), *Eranthis hiemalis* (fig. 10), *Nigella damascena* (fig. 11), *Anemone pusatilla* (cf. Zimmermann, 1939, figs. 13, 20, 23).

Berberidaceae — *Berberis thunbergii* (fig. 12); note the sympodial main nerve, as far as I am aware a rare phenomenon in the Angiosperms.

Nymphaeaceae — *Cabomba aquatica*, aerial and aquatic leaves (figs. 13—14); *Nuphar luteum* (fig. 15), with only very few lateral connections. In *Nymphaea* such connections are more numerous.

Aristolochiaceae — Main nerves strictly dichotomous in *Asarum europaeum* (fig. 16). The same type, but slightly more advanced, is found in *Aristolochia*.

Ceratophyllaceae — *Ceratophyllum*, aquatic leaves up to 3 times dichotomous (fig. 17).

Rhoeadales, Guttiferales, Myrtales — No evident traces of dichotomies have been detected by me in these orders, even not in *Myriophyllum*, whose leaves are monopodially nerved throughout.

Parietales — Distinct traces of dichotomy only in *Droseraceae*, e. g. in *Drosera binata* in which the leaves are twice furcate (cf. Lam, 1948, fig. 6), and in *Drosera intermedia* and *rotundifolia* (figs. 18—19). Weak traces of dichotomy are furthermore found in *Begonia*.

Rosales: Papilionaceae — neat dichotomous nerve endings are found in *Trifolium* (fig. 20) and *Medicago* (fig. 21).

Podostemaceae — numerous dichotomously segmented leaves are found in this group of aquatic plants, e. g. in *Mourera weddeliana* (many times furcate), *Pohliella laciniata, Inversodicraea* (fig. 22), *Macropodiella* and *Winklerella* (fig. 23). In the related *Hydrostachyaceae* the leaves are monopodially segmented.

Columniferae, Gruinales, Terebinthales, Celastrales, Rhamnales — no traces of dichotomy found.

Umbelliflorae — Some traces of dichotomies are found in *Umbelliferae* and *Araliaceae*, e. g. in *Anethum graveolens* (fig. 24), *Apium inundatum* and *Hedera helix* f. *arborescens* (fig. 25). In most *Umbelliferae* however, even in the aquatic leaves, the main ramification is pinnate and therefore monopodial.

Sympetalae.

In the *Sympetalae* cases of distinct dichotomy of stronger nerves seem to be rare. I found it in the following cases:

Pirolaceae — *Monotropa* (saprophytic, fig. 26).

Primulaceae — *Cyclamen* (fig. 27) shows the type of *Aristolochia.* The aquatic leaves of *Hottonia palustris*, however, are quite monopodial.

Of the *Tubiflorae* only *Utricularia* and *Genlisea* (*Lentibulariaceae*) show traces of dichotomies.

In the *Scrophulariaceae Limnophila* shows transitional stages between monopodially nerved aerial leaves and aquatic leaves with dichotomous ultimate segments. Much the same condition is found in *Bidens* (*Compositae*). Both cases are pictured by Goebel (1933, figs. 1648—1649).

MONOCOTYLEDONEAE.

Monocotyledonous leaves are generally parallel-nerved; even in the very basis no traces of dichotomy could be discovered in the adult leaf. Properly speaking, this is a surprising condition in a group with so many primitive characters. Maybe an investigation of the ontogeny will reveal dichotomies in early stages, comparable to those of e. g. *Agathis* and *Podocarpus.*

Quite another type, however, is found in the *Araceae,* in which *Amorphophallus* shows a primitive type of leaf (fig. 28). Each of the main parts of the leaf blade is forked, each daughter branch of a fork showing a very neat sympodial system.

Possibly the leaf venation of some other *Araceae* (fig. 29) bears some relation to this ramification.

Perianth.

Dichotomous venation seems to be much more frequent in the perianth leaves than in vegetative phyllomes. Particularly the petals of the majority of the Angiosperms show the phenomenon very clearly and only few species seem to be without any traces of dichotomous venation.

The most primitive condition being, of course, dichotomous venation without or with only a few lateral connections, I mainly looked for that type. It may be recorded in the following cases:

DICOTYLEDONEAE.

Monochlamydeae.

In the *Monochlamydeae* only the group with larger flowers, viz. the *Centrospermae,* was examined. In the *Caryophyllaceae* the petal nerves of *Cerastium* and some *Dianthus* species are dichotomous; in *Saponaria* there are some lateral connections and this character is still more advanced in such genera as *Coronaria, Melandrium,* etc.

In the *Caryophyllaceae* a great number of genera have bilobate petals e. g. *Melandrium, Silene, Stellaria, Malachium, Cerastium,* etc. This condition is possibly to be interpreted as a dichotomy. A peculiar condition is found in *Dianthus monspessulanus* (fig. 30), in which the petals are multifid and the segments are once or twice dichotomous.

Cactaceae — In *Echinocactus* petals the dichotomous nerves are not or hardly laterally connected; in *Echinopsis* these connections are few and in *Phyllocactus phyllanthoides* they are numerous.

Dialypetalae.

Very neat dichotomies are found in some *Ranunculaceae,* e. g. the petals of *Ranunculus* (fig. 31). In other genera lateral connections occur, sometimes so many as to convert the venation into a reticulate one (*Caltha*).

In the *Nymphaeaceae* the petals of *Nymphaea* show lateral connections; in *Nuphar* these lead to a reticulate venation.

In the *Cruciferae,* e. g. in *Matthiola incana* (fig. 32) the nerves make connections near the margin.

In the petal nerves of the *Papaveraceae,* the *Parietales* (incl. the *Begoniaceae*), the *Saxifragaceae* and the *Rosaceae* (among which *Fragaria* and *Potentilla*), lateral connections occur and these may sometimes lead to a reticulate venation (*Papaver, Rosa*).

In the *Papilionaceae* I found beautiful dichotomies in *Onobrychis* (fig. 33). In other species e. g. *Lathyrus* the nerves make cross connections.

Whatever there is of dichotomous petal nerves in the *Myrtales, Columniferae, Gruinales, Terebinthales* and *Umbelliferae,* is invariably accompanied by lateral connections.

Sympetalae.

Dichotomous petal nerves are found in *Pirola* (fig. 34). In such *Ericaceae* as *Rhododendron* the venation was found to be reticulate.

Very neat dichotomies, however, are found in the petals of many *Primulaceae* e. g. *Hottonia palustris* (fig. 35), *Lysimachia vulgaris* and particularly in *Cyclamen* (fig. 36). In *Primula* cross connections blur the picture.

The same is true in the *Tubiflorae, Contortae, Rubiales* and *Cucurbitales.* Particularly in the *Boraginaceae, Solanaceae, Scrophulariaceae, Orobanchaceae* and *Labiatae* the venation is reticulate.

Oleaceae — *Forsythia viridissima* (fig. 37) shows neatly dichotomous petal nerves; in *Jasminum nudiflorum* the nerves show some lateral connections.

Campanulaceae — Reticulate venation in the petals is the general condition.

Compositae — The petal nerves are connected near the margin e. g. *Anthemis mixta* (fig. 38).

MONOCOTYLEDONEAE.

The venation of the perianth of the Monocotyledones is generally dichotomous. As instances I may mention here *Alisma* (fig. 39), *Fritillaria meleagris* (fig. 40), *Tulipa* (fig. 41), etc. Of the *Iridaceae* the perianth venation in *Crocus* is dichotomous, in *Iris pseudacorus*, however, reticulate.

Canna has dichotomous venation with lateral connections.

In the *Orchidaceae* the nerves are sometimes strictly dichotomous, e. g. in *Orchis morio* (fig. 42), sometimes reticulate e.g. in *Dendrobium*.

Stamens.

Branched 'filaments' occur in a number of families and several of these are probably best interpreted as remainders of a dichotomous branching system. As has been pointed out by Lam (1948, p. 139) a general interpretation is not yet possible. The intrinsic value of phyllosporous stamens, i. e. microsporophylls, and of stachyosporous ones, i. e. supposed sporangium-bearing axes; their mutual relation; the origin and significance of basifix, introrse (dorsifix) and extrorse (ventrifix) anthers; these all are as many unsolved problems in the New Morphology. The cases mentioned underneath are therefore given without much critical comment. It is realised that their individual significance may widely differ from one case to another. Moreover several cases are unsufficiently known. Also and particularly in this field, ontogenetical investigations seem essential for a good understanding.

In general we can say that there are stamens of which we are inclined to call their filaments 'forked', and others in which we tend to use the expression 'connate'. Without intensive research it will, in some cases, be difficult or even impossible to decide which term should be chosen. It is true that 'forked' seems the more descriptive and therefore the more neutral of the two. On the other hand, the interpretation of an ancient dichotomy is lurking behind it. 'Connate' presupposes some secondary process of which there is no proof without an investigation of the ontogeny.

However, it seems not too far-fetched to consider a very general type of Angiosperm stamen as a stalk — whether an axis or a reduced leaf — with two pairs of sporangia on top. In these we might see two subsequent dichotomies and this interpretation is certainly confirmed by those cases in which either branch of a filament bears a bisporangiate theca instead of a tetrasporangiate anther. In other cases, however, either branch apparently bears a full anther, but these certainly require a closer investigation.

The first-named type, with two separate thecae is extant in *Betula* (cf. Lam, 1948, fig. 6), *Carpinus* (cf. Wettstein, 1935, fig. 403) and *Corylus*. The second type, with a tetrasporangiate anther on top of each branch, is found in *Salix* (cf. Lam, 1948, fig. 6). Here the bifurcation, if any, may be situated quite near the insertion (*S. cinerea*; cf. Lam, 1948, fig. 6) or about halfway up (*S. incana*, fig. 43) or immediately below the sporangia (*S. glauca*, fig. 44). In some species with normally unforked or nearly unforked filaments (*S. caprea, cinerea, fragilis, incana,* *repens*) there are occasional records of furcate filaments (var. *monadelpha*) and this is one of those cases in which it seems impossible to choose between 'forked' and 'connate'.

A family in which many cases of branched filaments occur is that of the *Euphorbiaceae*. Some of these branchings are dichotomies. I mention *Maprounea brasiliensis* (the ultimate ramifications only), *Lasiococca* and *Ricinus*. In *Ricinus* and *Maprounea* each ultimate branch bears a theca, in *Lasiococca*, however, an anther. In *Ricinus* (cf. Lam, 1948, fig. 6) I found a flat laterally attached structure which Lam with apparent conviction (or for the lack of better) interpreted as an angular leaf (l. c., p. 119).

Similar organs seem to occur in a number of *Podostemaceae*, e. g. in *Mniopsis saldanhana* (fig. 46). The lateral structure in these cases has been interpreted as a reduced perianth leaf. This may be correct, but even then its position would probably stamp it as an angular leaf to the bifurcation of the filament.

More dubious cases are found in such families, in which stamens are known to grow in bundles, e. g. in the *Malvaceae, Bombacaceae*, in *Pandanus*, and possibly in some other groups. In most of these cases secondary connections will probably play an important part and their ultimate interpretation will have to wait until much more essential data are available. A remarkable fact is that in the *Malvaceae, Bombacaceae* and *Guttiferae* the ultimate ramifictions bear single thecae.

Stigmata.

Without venturing to give an interpretation we may state here that forked stigmata are known to occur in *Mirabilis viscosa* (*Nyctaginaceae*), *Begonia* (cf. Lam, 1948, fig. 6), *Carica* (*Caricaceae*) and many *Euphorbiaceae*, e. g. *Agithamnia* (fig. 47), *Erismanthus* (fig. 48), *Ricinus* (fig. 49), *Jatropha* and *Epiprinus*. Since stigmata probably are phyllome-tips in any case, their eventual dichotomy is not surprising at all. (Nor would it be if they were axes, for that matter).

Teratologies.

Spontaneous teratologies are largely depending on their numerical occurrence. If they are rare enough, they are considered 'abnormal', if they are less rare, they are considered a part of the genotypical variability — which they are in any case, if the time factor is included in the picture, as they cannot be but based upon the potentialities incorporated in the plant.

Only few of the above-mentioned instances may be called teratologies e. g. the var. *monadelpha* in some *Salix* species. Teratologies are particularly interesting in case they probably may be interpreted as atavisms e. g. in the stem dichotomies of *Arenga* and *Cocos*.

Next to these there are many records of bifurcations in stems and leaves that probably proceed from damages of the growing point and have no phylogenetical value at all.

Conclusions.

It may be asked what is the bearing of traces of dichotomy in various organs in the Angiosperms on our opinion about the system, particularly in connection with Lam's groups of *Phyllosporae* and *Stachyosporae*.

If it may be assumed that the structures described above are dichotomies or traces of dichotomies, and this is hardly doubtful; if the dichotomies found in the Angiosperms are homologa of those in the Ferns; and if therefore, in the Angiosperms, dichotomy is to be considered a primitive character, the following conclusions might have some importance.

1. Stem dichotomy is often (always?) accompanied by an angular leaf.
2. The fact that in a few groups (*Euphorbiaceae, Podostemaceae*) forked filaments are provided with a lateral structure at one side of the bifurcation might stamp these bifurcations as stem dichotomies and the plants therefore as stachyosporous.
3. Lam's thesis that traces of dichotomy are particularly found in the vegetative parts of the *Phyllosporae* and in the generative ones (filaments) of the *Stachyosporae* (in his provisional delimitation) has partly been confirmed, but there are some noteworthy exceptions.

It is true that the more primitive type of venation is abundant in the obviously phyllosporous *Polycarpicae*, but it is wanting or almost wanting in many other orders (*Rhoeadales, Guttiferae, Myrtales*). A remarkable fact is that some *Papilionaceae* show very neat nerve dichotomies, whilst the related *Rosaceae* do not. In the *Parietales* only the *Droseraceae* and, though less obviously, *Begonia* show nerve dichotomies. In the *Umbelliflorae* there are some traces, but they are weak, even in the aquatic leaves of some *Umbelliferae*.

Dichotomy of the stronger nerves is not found in the *Monocotyledoneae*. This is surprising on account of their obvious relationship with the *Polycarpicae*. Maybe nerve dichotomies are hidden in the most basal part of the leaf, maybe the fact is due to other peculiarities of the parallel-nerved leaf. Anyhow, a very striking exception is made by the *Araceae* in which a very primitive type of ramification is found in the leaf of *Amorphophallus*. Possibly the leaf venation of other *Araceae* has some relationship to this ramification.

In the *Sympetalae*, dichotomous venation occurs in the, possibly stachyosporous, *Primulaceae* (but not in the aquatic leaves of *Hottonia*). Some other traces are restricted to aquatic leaves, e. g. *Utricularia* (*Lentibulariaceae*), *Limnophila* (*Scrophulariaceae*) and *Bidens* (*Compositae*).

In the *Monochlamydeae* dichotomous nerves are practically wanting; the main exceptions being the *Proteaceae* and *Buxus*, whose systematic positions are often regarded as doubtful.

With some hesitation I make the following conclusions: According to their venation type the *Proteaceae* differ from the greater part of the stachyosporous *Monochlamydeae*; possibly they are phyllosporous really.

The allegedly stachyosporous *Primulaceae* show some instances of primitive venation. This separates them from the greater part of the *Monochlamydeae*, but not from the *Polygonales* and *Centrospermae*.

The allegedly stachyosporous *Araceae* also show traces of primitive leaf venation; possibly they are phyllosporous really.

4. Dichotomy seems to be furthered by environmental stimuli, such as endophytic *Fungi* and *Algae* (roots or rhizomes of *Cycadaceae, Coniferae, Orchidaceae, Burmanniaceae*), aquatic life (leaves of *Cabomba*, etc.), and perhaps insectivory (leaves of *Drosera*) and saprophytism (*Monotropa*).

As to the influence of aquatic life, the potentiality to the dichotomous type of ramification should of course be primarily extant, but even in plants in which the aerial leaves are monopodially veined, the aquatic ones often show gradual transitions to dichotomy (*Limnophila, Bidens, Umbelliferae*).

On the other hand the aquatic leaves of *Hottonia palustris* are monopodially branched but the aerial leaves of *Cyclamen* show dichotomous nerves.

On considering leaf venation from the viewpoint of organogeny, it should be constantly borne in mind that venation is a character most likely to be subject to ontogenetical and phaenotypical modifications. This is the principal reason, why in this comparing investigation only the more evident cases have been considered.

5. Petal venation, being much oftener dichotomous, is therefore less significant. It seems as if the leaves in the reproductive region are more conservative in this respect.

However, dichotomous petal venation without lateral connections (open venation) only occurs in the following groups: *Centrospermae, Ranunculaceae, Papilionaceae, Primulaceae, Pirolaceae, Oleaceae* and the greater part of the *Monocotyledoneae.*

6. As long as so few essential and fundamental facts concerning the Angiosperm stamens are known, it is useless to try and interpret the few cases of dichotomy in the filament, the more so since apparent dichotomy and secondary coalescence cannot be discriminated without a thorough ontogenetical investigation.

The cases of furcate filaments can be arranged in the following groups: *Betulceae*; *Salix*; *Euphorbiaceae* and *Podostemaceae*; *Malvaceae* and *Bombacaceae*; *Pandanus.*

In the *Euphorbiaceae* and *Podostemaceae* occasional 'angular leaves' are found which seem to support both the interpretation of a dichotomy and the state of stachyospory.

It is difficult to say what relation the bundled filaments (often with a theca instead of an anther on top) in such families as the *Malvaceae* and *Bombacaceae* may have to those mentioned earlier. The often mentioned relation to the *Euphorbiaceae* seems not impossible.

7. Furcate stigmata are few in number. No conclusions whatever can be based on so scarce a material.

8. It provisionally seems that the distribution of phyllospory and stachyospory in the Angiosperms is more intricate than was originally conceived. Further investigations in this field are urgently needed.

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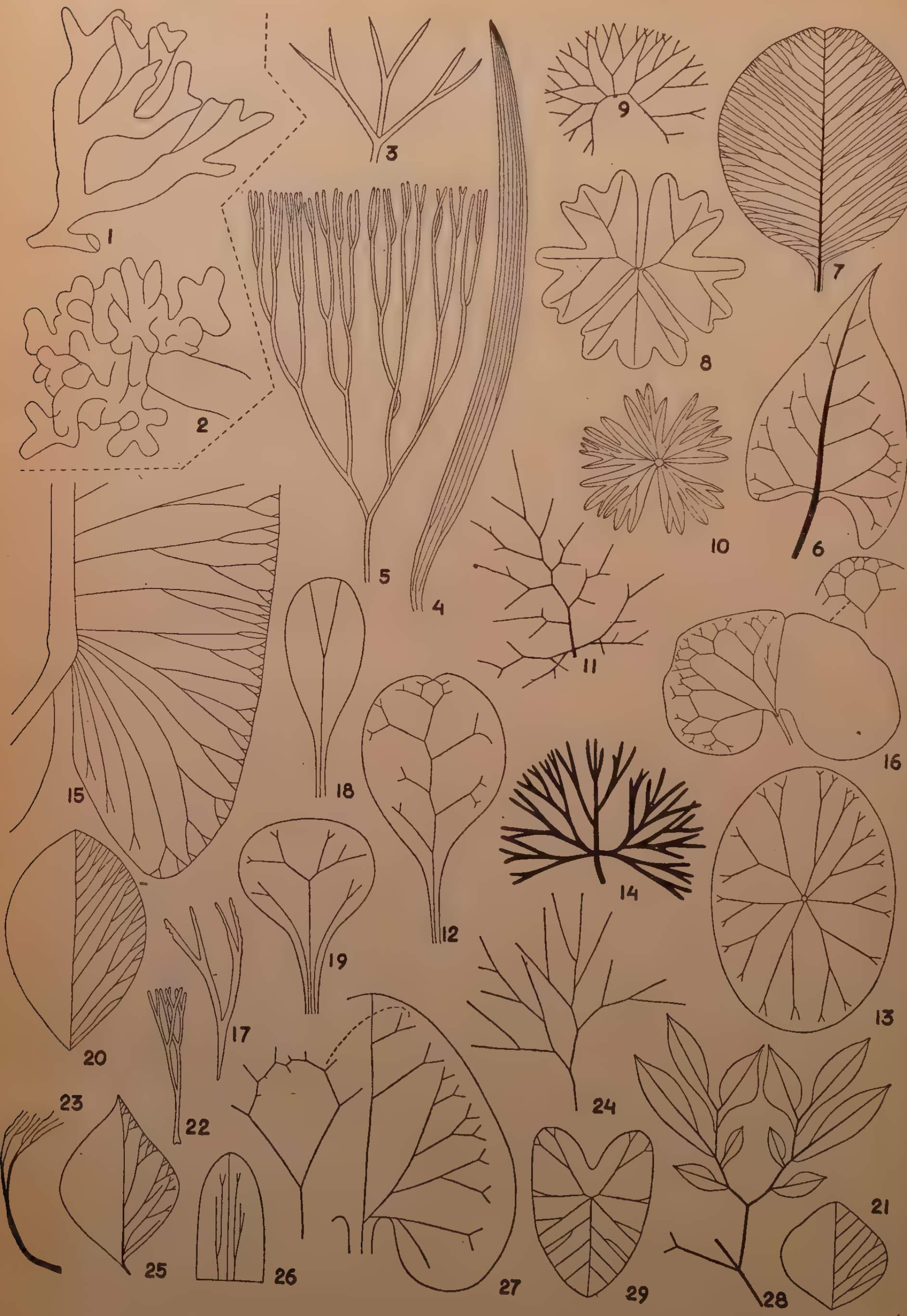

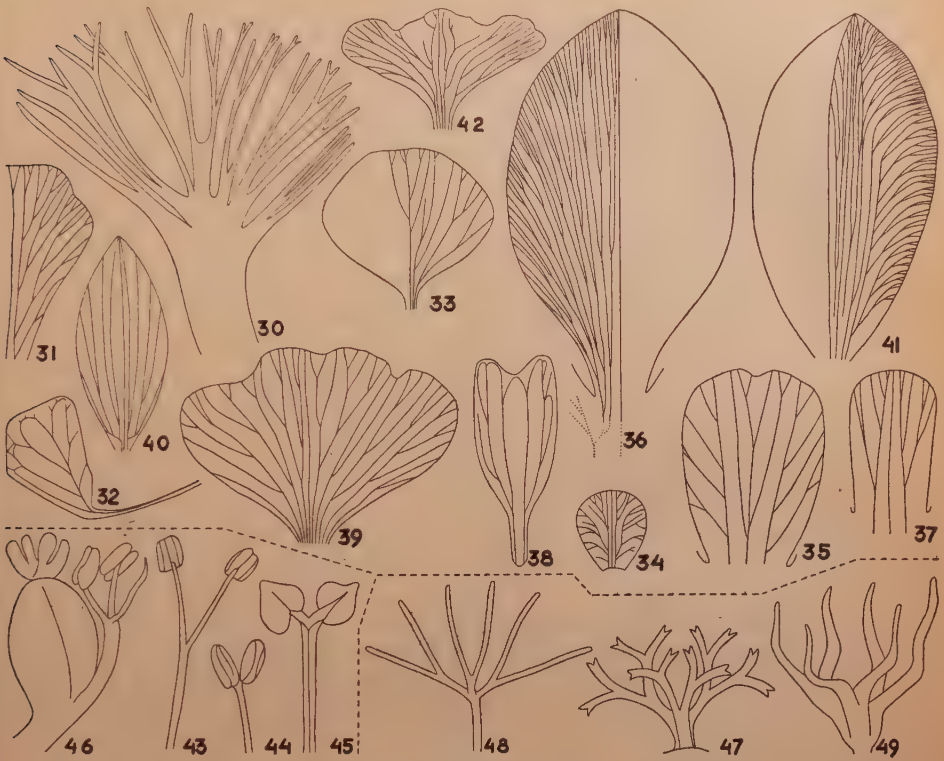

Legend to the figures

(s. dried material; v. living material; alc. alcohol material).

Roots and rhizomes — 1. *Dioon edule*, roots, v. — 2. *Sarcosiphon episcopalis*, rhizome, after Beccari from Wettstein.

Leaves — 3. *Hakea erinacea*, s. — 4. *Hakea multilineata*, s. — 5. *Franklandia fucifolia*, s. — 6. *Polygonum convolvulus*, s. — 7. *Buxus sempervirens*, alc. — 8. *Batrachium aquatile*, aerial leaf, s. — 9. *Batrachium divaricatum*, aquatic leaf, v. — 10. *Eranthis hiemalis*, v. — 11. *Nigella damascena*, subfloral bract, s. — 12. *Berberis thunbergii*, alc. — 13. *Cabomba aquatica*, aerial leaf, s. — 14. *Cabomba aquatica*, aquatic leaf, v. — 15. *Nuphar luteum*, s. — 16. *Asarum europaeum*, v. — 17. *Ceratophyllum demersum*, s. — 18. *Drosera intermedia*, s. — 19. *Drosera rotundifolia*, s. — 20. *Trifolium pratense*, s. — 21. *Medicago lupulina*, s. — 22. *Inversodicraea zenkeri*, after Engler and Prantl. — 23. *Winklerella dichotoma*, after Engler and Prantl. — 24. *Anethum graveolens*, s. — 25. *Hedera helix* f. *arborescens*, v. — 26. *Monotropa hypopitys*, s. — 27. *Cyclamen persicum*, v. — 28. *Amorphophallus* spec., s. — 29. *Colocasia* spec., v.

Perianth — 30. *Dianthus monspessulanus*, s. — 31. *Ranunculus sardous*, s. — 32. *Matthiola incana*, s. — 33. *Onobrychis viciaefolia*, s. — 34. *Pirola rotundifolia*, s. — 35. *Hottonia palustris*, s. — 36. *Cyclamen persicum*, v. — 37. *Forsythia viridissima*, s. — 38. *Anthemis mixta*, s. — 39. *Alisma* spec., alc. — 40. *Fritillaria meleagris*, s. — 41. *Tulipa* spec., v. — 42. *Orchis morio*, s.

Stamens — 43. *Salix incana*, after Heimans, Heinsius and Thijsse. — 44. *Salix purpurea*, after Heimans, Heinsius and Thijsse. — 45. *Maprounea brasiliensis*, after Wettstein. — 46. *Mniopsis saldanhana*, after Engler and Prantl.

Stigmata — 47. *Argithamnia candicans*, after Engler and Prantl. — 48. *Erismanthus sinensis*, after Engler and Prantl. — 49. *Ricinus communis*, after Wettstein.

NOTES ON THE FLORA OF JAVA, III [1]
SOME REMARKS ON THE MORACEAE OF JAVA

by

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(Heemstede, Holland)

(Issued on I. VI. 1948).

MORUS.

See for the confusion reigning about the species of this genus Journal of the Arnold Arboretum VIII (1927), 234 seq. The only species cultivated in Java (not so much for its fruit as for its medicinal properties) is *M. australis* Poir. Formerly it went by the name of *M. alba* L. from which it differs i. a. by its shining dark-red or almost black fruits.

CUDRANIA.

Cudrania cochinchinensis (Lour.) Backer nov. comb. — *Vanieria cochinchinensis* Lour., Fl. Cochinch. (1790) 564 — *Cudrania spinosa* (Bl.) Hochr. in Bull. N. Y. Bot. Gard. VI (1910) 271.

ARTOCARPUS.

In the Gardens' Bulletin X (1939), pp. 56 seq. Corner published the results of a profound study on some cultivated species of this genus. He arrived at the conclusion that the species hitherto named (in Java) *A. integrifolia* L. f. [= *A. integra* (Thunb.) Merr.] should be called A. heterophylla Lmk. — *A. polyphema* Auct. plur. has to bear the name A. integra (Thunb.) Merr. sensu Corner non sensu Merr. This long phrase may be correct but is certainly not simplifying matters.

FICUS.

Valeton, when treating the Javanese species of *Ficus* in Koorders et Valeton, Bijdrage XI, pp. 31 seq., closely followed King's monograph. He considered it useless to describe the species afresh but had King's descriptions translated into Dutch by a person knowing nothing of systematic botany and possessing only a very scanty knowledge of English. The obvious result was that the translations teem with inaccuracies; nevertheless Valeton entered them without corrections in his paper, adding however, in Dutch, many well-founded remarks not rarely in flat contradiction with the translations. Hence Valeton's paper is to the Dutch reader equivocal and, on the whole, unsatisfactory. I have made new descriptions in Dutch of all Javanese species, which I intend to publish as soon as I can find time to translate them, but first my collaborators and I have to finish the Noodflora (Emergency-flora) which probably will take for some years to come all our time. In the meantime I give here beneath a few remarks on some Javanese species, recording them under the numbers under which they were published in Bijdrage XI, adding descriptions of a misidentified and of a new species.

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[1] II in Blumea V, 3, 1945, 490—524.

1. **Ficus saxophila** Bl. Recorded by Blume (Bijdragen 438) for West-Java. Without any doubt this statement is incorrect; after Blume the tree was never found back in Java but repeatedly in the eastern half of the Malay Archipelago. Blume's statements in his 'Bijdragen' are often palbably untrue[1]; he was a gifted but very unscrupulous botanist.

2. **Ficus cordifolia** Bl. (non Roxb. nec K. & V.).

There is some confusion about *F. cordifolia* Bl. It is certainly not identical with the plant described by Koorders and Valeton [Bijdrage XI (1906) 57] under this name. The true *F. cordifolia* Bl. is represented in the National Herbarium at Leiden by authentic but rather scanty and bad material consisting of a branchlet bearing a few leaves and a small envelope containing one damaged receptacle. On these materials the following description is based:

Receptacles in the axils of fallen leaves on small woody tubercles; their peduncles thin, somewhat squamous, glabrous ± 1¼ cm; receptacles globose or obovoid, 2—2¼ cm across; basal bracts 3, verticillate immediately below receptacle and appressed against it, small; stomatal part of the only available receptacle lost; wall of receptacle rather thick, glabrous on the inside; flowers many, all ♀, sessile, sepals (number unascertainable) free, narrowly linear-subulate glabrous ± 2 mm long; ovary borne by a short glabrous stalk, obliquely obovoid, compressed, style subbasal glabrous, ± 1½ mm (including thick vermicular-clavate stigma); other flowers unknown as are the fruits.

Old twigs brownish yellow with scaly bark, glabrous; stipules acuminate from a broad base, densely and finely hoary on the back, 1—1½ cm long; leaves alternate, ovate-cordate, broadest far above the cordate 5—7-

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[1] A few instances may be cited here: p. 53. *Capparis callosa* Bl.: in paludosis Javae insulae. This shrub never occurs in swamps. — pp. 724/725. *Evolvulus javanicus* Bl. (= *E. alsinoides* L.): in summo montis ignivomi Gede (W.-Java, alt. ± 2960 m). The plant is limited to the eastern part of the island in regions with a very dry climate, where, between 10 and 100 m above sea-level, it grows on calcareous rocks. — p. 72. *Hibiscus sabdariffa* L.: in paludosis Bataviae. It is no Javanese marshplant but an introduction from America, in Java only known in cultivation. — p. 73: *Thespesia populnea Corr.*: in cultis. The plant never occurs in plots used for cultivation but is restricted to not-swampy shores and the inner margin of broadish tidal forests.

nerved base, not or hardly acuminate, with slightly repand margins; costa rather strongly prominent beneath; lateral nerves on either side of costa 5—9 oblique-ascending, rather thin, prominent beneath; leaves between lateral nerves cancellate-veined, with the exception of the finely pubescent larger nerves glabrous above, beneath rather densely clothed with patent moderately long white soft hairs, 11—25 cm by 7½—14 cm; petiole moderately densely and finely pubescent 2½—7½ cm. Tree. For the rest unknown.

This imperfectly known species is closely allied to and perhaps not specifically distinct from *F. variegata* Bl., a tree rather common throughout Java between 5 and 1500 m above sea-level.

The tree described by Koorders and Valeton under the name *cordifolia* is quite another species, differing i. a. by the receptacles being hairy within and without and containing the 3 kinds of flowers, furthermore by the stigma consisting of 2 minute caducous lamellae; the leaves also are very different. — Koorders, who in 1889 discovered this species in Java, misidentified it as *F. melinocarpa* Bl. — Valeton (Bijdrage XI, 59), aware of this mistake, recognized it as a new species which he gave the msc name of *F. mallotoides*, but afterwards he fell into the error of identifying it with *F. cordifolia* Bl., under which name he gave a Dutch and a Latin description of it.

As has been shown above the latter identification also was incorrect; as a matter of fact it was a new species. The name *F. mallotoides* Val., having never been legitimately published has to be considered invalid. But as Valeton gave excellent descriptions of the species it is only fair to restore the name originally given by him to the tree which should be called: *F. mallotoides* Val. ex Back.

2bis Ficus mallotoides Val. ex Back. (*F. cordifolia* Bl. ex Val. in K. et V., Bijdrage XI, pp. 57, 60; descriptiones tantum).

Receptacles (♂ g ♀1)), in axils of fallen or present leaves, geminate or by abortion solitary, peduncled (peduncles $^{1}/_{3}$—1 cm, densely clothed with longer or shorter, white hairs) depressed globose, not or faintly umbonate, more or less densely clothed with patent short white hairs sometimes intermixed with a few longer ones, 1¼—1½ cm across (not yet known in a fully mature state); base broadly rounded or truncate; basal bracts 3, appressed against base of receptacle, verticillate, free or shortly connate, broadly rounded, on the back densely clothed with rather long white hairs, 1—1½ mm long; mouth of receptacle surrounded by a slightly prominent ring; apical bracts few; exterior ones horizontal or slightly slanting, broadly oval-obovate, rounded or very obtuse, hairy or glabrous 1¾—2 mm diam.; following ones horizontal, inmost ones more or less strongly deflexed glabrous; wall of receptacle rather thick (especially at base and apex), between the flowers with many patent longish white hairs); perianth pink. ♂: flowers in apical part of receptacle, rather numerous, shortly stalked

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1) This sign denotes that male flowers (♂), gall flowers (g) and female flowers (♀) are contained in a same receptacle.

or sessile; tepals 5 or sometimes 4 free, oval-obovate or oblong-obovate rounded glabrous or hairy at base within, 2—2½ mm long; stamen 1, much shorter than perianth; filament robust much thickened upwards; anther oblique oval, emarginate 1—1¼ mm; connective not produced above the cells; no rudimentary ovary; g and ♀ flowers intermixed, copious, sessile or stalked (stalk up to 2 mm), externally almost quite alike; sepals 5 or sometimes 4, rarily 6—8, long ovate-triangular-oblong or oblong-obovate; style lateral, thin, white, in g 1½—2 mm, in ♀ 2—3 mm; stigmas of ♀ (often sticking together in centre of receptacle) consisting of 1—2 minute lamellae, in dry materials caducous; fruit small, smooth.

Branchlets round, with short apical internodes; when young varying from densely hoary to glabrous; stipules involute, narrowed from a broad base, on the back densely clothed with appressed long white hairs; glabrous on the inside, ½—2 cm long; leaves often crowded on short lateral branches near tops of twigs, alternate, ovate-oblong from an oblique or equalsided slightly cordate or truncate, rarely profoundly cordate base, broadest below the middle or near the base, from there to top tapering or slightly acuminate, acute, entire or (in watersprouts) obtusely serrate, herbaceous or thinly coriaceous, above shining, smooth glabrous, beneath dull pale green, *in sicco* conspicuously pale green on both surfaces, beneath either clothed all over with patent long soft hairs or pubescent on nerves and veins only, or glabrous, penninerved from a 3-nerved base, lateral basal nerves either parallel to following lateral nerves or not; midrib strongly prominent beneath, lateral nerves on both sides of midrib 5—16 (above basal nerves) rather widely patent, almost straight but ascending near leaf-margin, thin, prominent beneath; leaves between lateral nerves cancellate-veined and reticulate, 10—24 cm by 5—12½ cm; petiole softly pubescent or glabrous, 2½—8½ cm. Lofty thick tree, conspicuous by its strongly buttressed [see Backer, Schoolflora van Java (1911) plate XI] smooth greenish grey bole, 20.00—40.00 m high. No aerial roots.

Occurs in the eastern half of Java between 10 and 750 m above sea-level in periodically dry regions.

Type-specimen: Hortus Bogoriensis VIII. D. 12, living specimen from which the photo in 'Schoolflora' was taken. Description of general habit after this specimen and after notes made by Koorders on a specimen from Mount Wilis (8934β).

6. **Ficus pilosa** Reinw. ex Blume. Sometimes with many aerial roots forming together a thick spurious trunk. Young shoots densely clothed with erecto-patent long thin yellow or brown hairs, tardily glabrescent; leaves 9—30 cm by 4—11 cm. Adult receptacles in vivo 2—3 cm across; ♂ perianth often 3-merous; style in g and ♀ lateral near apex of ovary; stigma in g flattened, in ♀ subuncinate.

11. **Ficus edelfeltii** King. New-Guinean species. Koorders wondered at the enigmatical fact that this in Java rather common tree was not collected there before he discovered it in 1891. The puzzle can easily be solved. The tree mentioned by Koorders and Valeton as *F. edelfeltii* is not at all that species (as described by King) but simply *F. nervosa* Heyne which was mentioned for the island by Blume (under the name of *F. magnoliaefolia* Bl.) as early as 1825 and again in 1859 by Miquel (*Urostigma nervosum* Miq. = *U. euneuron* Miq.).

The 2 species may be distinguished by the following characters:

F. nervosa Heyne	*F. edelfeltii* King (according to King, not seen by me).
Sepals in ♂ 2—3, oval-oblong, in g and ♀ 3—4, oblong or oblong-spathulate.	Sepals in ♂ and g 5, narrowly semilunar, in ♀ 4, broad semilunar.
Filament thin 1—1½ mm.	Filament thick, short.
Stigmas 2, long thin, twisted together.	Stigma 1 simple.

12. Ficus kerkhovenii K. et V. This is not a good species but simply a form of *F. procera* Reinw. ex Bl. from which it differs by no character of specific value.

30bis (not in K. et V.). **Ficus fairchildii** Back., nov. spec.

Tota planta, bracteis ad receptaculi basin exceptis, glabra. Receptacula (♂ g ♀[1]) in axilis foliatis defoliatisve solitaria sessilia ellipsoidea basi rotundata, apice rotundata vel subtruncata, ore haud vel vix prominulo, primo aurantiaco-flava, provectiore aetate laete rubra, postremo subnigra, adulta (in vivo) 3—3½ cm longa, 2¼—2½ cm lata, basi suffulta bracteis 3, sub receptaculo ± occultis, persistentibus, 2—3 mm longis, multo latioribus quam longis late rotundatis, intus glabris, extus densiuscule vel sparse obsitis pilis patentibus brevibus longiusculisve; bracteae ostiariae horizontales ovato-triangulares acutae 2—2½ mm longae; receptaculi paries intus onustus bracteis numerosissimis patentibus anguste triangularibus acutis membranaceis 2½—4 mm longis. — ♂ : flores numerosi per totum parietem interiorem dispersi, sustenti pedicellis crassis 1½—2½ mm longis; tepala 4—5 ovalia tenuiter membranacea ± 1½ mm longa; stamen unicum; filamentum crassum, maxime ad 1¾ mm longum; anthera vix exserta, ± ¾ mm longa; thecae deorsum divergentes. — g et ♀ : flores numerosi per totum parietem interiorem dispersi, intermixti, exterius subsimiles, sessiles vel stipitibus usque ad 5 mm longis suffulti; tepala 4—5 libera ovato-oblongo-spathulata, apice acuta obtusa vel rotundata 1—2 mm longa; ovarium laeve; stylus supra medium ovarium lateralis tenuis, basi saepe decurvus et vertici ovarii appressus, hinc spurie terminalis 1—4 mm longus; stigma (in sicco facile deciduus) planum, latum; stigmatibus saepe in medio receptaculo secus margines cohaerentibus; putamen laeve.

Truncus crassus basi saepe munitus erismatibus radicalibus [2] alte adscendentibus; ramuli pallide brunnei vel griseo-brunnei; stipulae (novellae tantum a nobis visae) fugacissimae; folia oblonga vel ovato-oblonga, basi aequalia cuneata, obtusa rotundatave, apice breviter obtuse acuminata firme coriacea 9—14½ cm longa 4—7½ cm lata penninervia, basi interdum subtriplinervia, in utroque latere costae (subtus valde prominentis) pertensa nervis lateralibus creberrimis patulis, subtus (in sicco quoque supra) prominentibus, in nervum intramarginalem manifestum confluentibus; nervi

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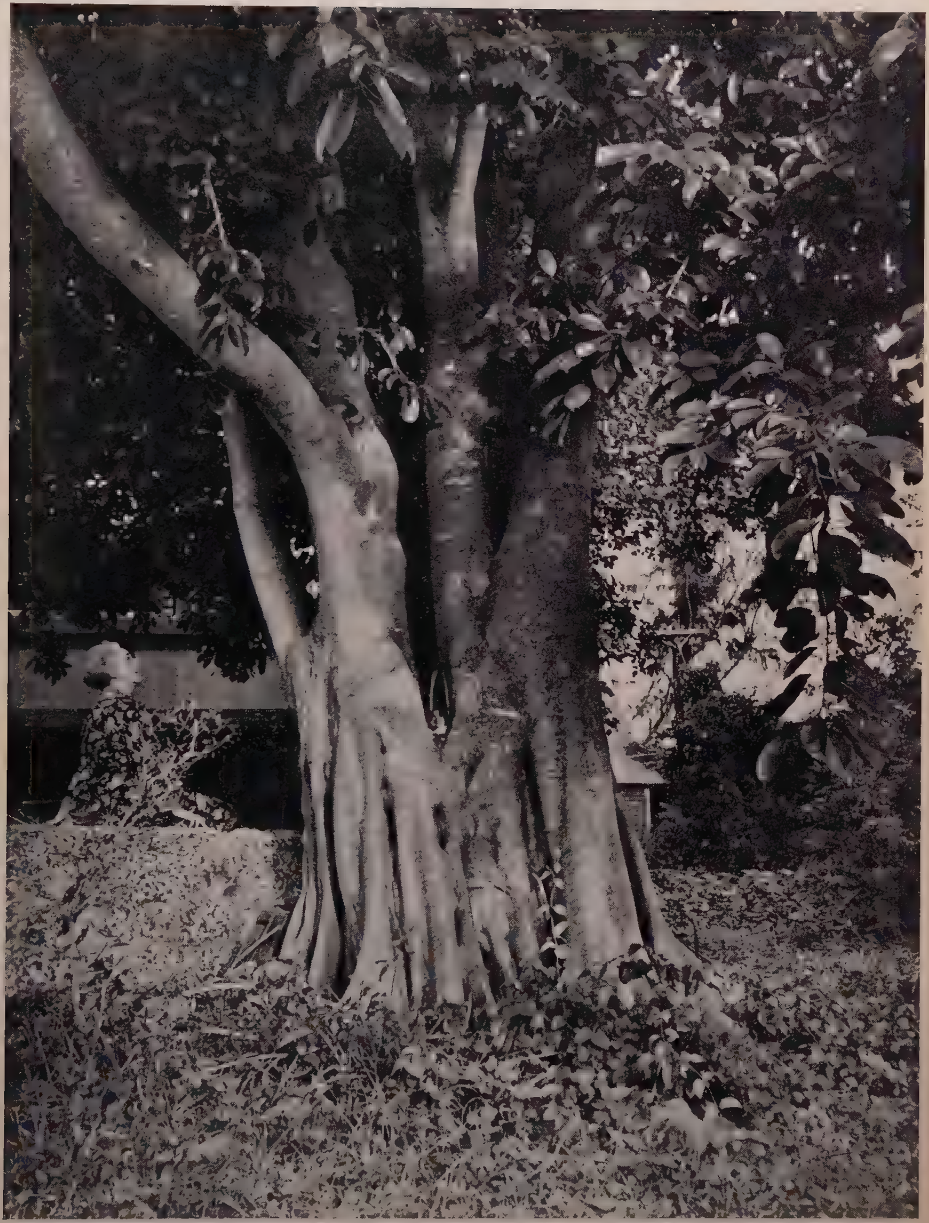
[1] This sign denotes that male flowers (♂), gall-flowers (g) and female flowers (♀) are contained in a same receptacle.

[2] erisma radicale = Engl. buttress.



Ficus fairchildii Back., n. sp., in Dr Fairchild's garden at 'The Kampong', Coconut Grove, Florida. Mrs Fairchild seated on wall. Febr. 23, 1948.

interpositi [1]) quam primarii vix tenuiores, reticulatione conspicua inter sese et cum nervis lateralibus primariis connexi; petiolus 2¼—3¾ cm. Arbor rapide crescens, usque ad 20 m alta; trunco unico vel pluribus crassis brevibus, saepe munitis nonnullis radicibus grallaribus [2]) robustis; capite lato, radicibus aëreis e ramis enatis carente.

JAVA, Pasoeroean, Oemboelan (E. of Pasoeroean). alt. ± 75 m, bank of a small lake, one specimen, *Backer 37528* (*type specimen*), 23. VI. 1926 (Leiden); — Soerakarta, Karang Pandan (western slope Mt. Lawoe), alt. ?, cultivated in a private garden as a shade-tree, *David Fairchild 67502*; 7. V. 1926.

The last-named specimen I did not see myself. Seeds in 1926 taken from ripe fruits lying under it were collected by Mrs and Mr Fairchild and sent (under the number 67502) to the Bureau of Plant Industry, Washington U. S. A. From them were raised about 200 plants; some of these were planted in the Fairchild Tropical Garden round Mr Fairchild's home, The Kampong, Coconut Grove, Florida. Of the biggest of these trees, now 22 years old, Mr Fairchild recently sent me the following description: "It is 15 feet (4½ m) around at 2 meters above the soil and has 4 trunks each 1½ foot (45 cm) in diameter. These "trunks" form buttresses from which enormous roots, 20′ (6 m) or more long spread out over the limestone rocky soil. No hanging roots descend from the main branches. The trunk is about 6 feet through now. The four trunks make the whole trunk hard to measure in diameter." Under this tree, as Mr Fairchild with some pride informed me, already 4 marriages have taken place. Materials taken from this „marriage-tree" were sent to me and will be handed over to the National Herbarium, Leiden.

The species comes nearest *F. elastica* Roxb. which may be easily distinguished by the following characters:

Receptacles geminate, only 1—1½ cm long, yellowish green, when young entirely enclosed by a calyptriform coriaceous-fleshy bract, afterwards circumsciss at the base, falling off and disclosing the shortly stalked receptacle; basal bracts 3, caducous; style lateral quite near top of ovary, hooked at apex. Stipules (unique in the genus) very conspicuous, connate into a long mitre abruptly terminated by a long point, bright red on the outside, paler within, 7—30 cm long, soon falling off. Leaves 7½—30 cm by 5—16½ cm, thickly coriaceous. Old trees provided with many aerial roots descending from the branches until they reach the ground and then increasing much in thickness.

I respectfully dedicate this fine species to him who was the first to collect it (as far as I know at present; the Buitenzorg herbarium being as yet inaccessible), the eminent American scientist and collector Dr David Fairchild [3]).

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[1]) i. e. lateral nerves emitted from the costa between the main lateral nerves and parallel to these.

[2]) radix grallaris = stilt-root arising from the basal part of the trunk.

[3]) David Grandison Fairchild, born April 7th 1869, East Lansing, Mich. U.S.A., graduated 1888, began in 1889 his scientific career as a phytopathologist. In 1895 he accompanied the then Director of the Buitenzorg Botanical Gardens (= 's Lands Plantentuin = Hortus Bogoriensis), the unforgettable Melchior Treub (of whom he stood much in awe) to Buitenzorg where he was given a table in the Botanical Laboratory and

32. Ficus religiosa L.

Only in a few of the receptacles examined by me I could find ♂ flowers and always but few; in most receptacles I could find no ♂ flowers at all.

33. Ficus superba Miq. As already pointed out by Koorders and Valeton the description given by King is not quite correct. The very caducous stipules are linear, 5—10 cm long. The receptacles are placed on short axillary branchlets in the axils of crowded squamiform bracts. With long intervals a couple of receptacles develop in the axil of the then undermost one of these scales, which thereupon falls off. Adult receptacles measure 2—2¼ cm across; their basal bracts, as King rightly says, soon drop, leaving a very narrow rim as mentioned by Valeton. Leaves 12—25 cm by 6—13½ cm; petiole 4—20 cm. Grows frequently (not exclusively) near the sea as an epiphyte high up on other trees. Rather common on old coral islands.

34. Ficus infectoria Roxb. and **35. Ficus glabella** Bl. These two species pass imperceptably into each other; they show no constant points of difference and had better be united into a collective species which should be called *F. glabella* Bl. s.l.

41. Ficus melinocarpa Bl. This species had better be transferred to the section *Covellia*. It is often confounded with *F. fistulosa* Reinw. ex Bl. and *F. lepicarpa* Bl. The older twigs of all of these 3 species are hollow. They may be distinguished by the following characters:

Leaves reticulate but not conspicuously cancellate-veined between primary lateral nerves, quite glabrous (also on lower part of upperside of midrib). Receptacles either on old wood or on foliate or defoliate young twigs, distinctly stalked; basal bracts 1—1½ mm long; (♂ g) receptacles glabrous within; tepals of ♂ flowers 2—3; perianth of g pouch-like; ♀ receptacles either glabrous of pubescent within; ♀ perianth wanting or minute, obconical, truncate; style shortly hairy near apex.
F. fistulosa Reinw. ex Bl.

Leaves conspicuously cancellate-veined between primary lateral nerves, hairy at least on lower part of upperside of midrib. Receptacles on the twigs. Style of ♀ glabrous.

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carried out investigations on the Fungus-gardens of the Termites (not published). In 1896 he began, at first (1896—1903) under the auspices of Barbour Lathrop, a long and very fruitful series of travels over a great part of the world for the purpose of collecting plants valuable for introduction in America. During this period of travelling which lasted till 1944 he visited Africa, Argentina, Australia, Bali, Brazil, British India, Ceylon, Chile, China, Cochinchina, Columbia, Egypt, Fiji, Guatemala, Hawaii, Italy, Japan, Java (3 times, lastly in 1926 when he discovered the above described Ficus and I had the pleasure to meet Mrs and Mr Fairchild), the Mediterranean countries, the Moluccas, New Guinea, New Zealand, Panama, Persia, Peru, Philippines, Samoa, Siam, Sumatra, Venezuela and West Indian Islands (i. a. Bahama Islands, Jamaica, Trinidad). He collected and shipped to Washington upwards of 150 000 shipments of living seeds and plants, many of which have now become valuable plant industries. In 1897 he organized the Office of Plant Industry at Washington of which he was in active charge from 1903—1925; he helped to organize several expeditions (i. a. that of Frank N. Meyer to China); these expeditions brought in over 50 000 introductions. He built up Introduction Gardens in South Florida: one of them near his present abode, The Kampong (Coconut Grove) where he still lives, enjoying the peaceful fruits of his unremitting labours. He is the author of 67 papers among which the interesting books: *Exploring for Plants* 1930, *The World was my Garden* 1941, *Garden Islands of the Great East* 1943, *The World Grows Round my Door* 1947. In 1914 he was elected president of the American Genetic Association which honourable post he still holds. In recognition of his eminent services he was loaded with honours.

Receptacles stalked; basal bracts 2—3 mm long; tepals of ♂, g and ♀ 5—6, well-developed, free, narrowly spathulate, 1½—4 mm long, often very unequal. **F. melinocarpa** Bl.

Receptacles sessile; basal bracts 4—10 mm long; tepals of ♂ 3; perianth of g pouch-like; tepals of ♀ united into a minute obconical truncate or obscurely toothed cup. **F. lepicarpa** Bl.

42. Ficus ampelas Burm. Often a trunk-clasping epiphyte but in Java never a true climber.

52. Ficus conjugata Miq. This species has never been collected in Java (main island). The type-specimen hails from the small island Dwars-in-den-Weg in the Sunda-straits, which administratively falls under Java.

53. Ficus aurantiaca Griff. In The Garden's Bulletin X, part 1 (1939) pp. 82 seq. Corner gave an excellent review of the subgenus *Synoecia* to which this species belongs. He arrived at the conclusion that the name *F. aurantiaca* Griff. had better be abandoned. The very rare Javanese plant should be named *F. trachycoma* Miq.

55. Ficus callicarpa Miq. Not seen by me; exact status unknown. It may be a form of *F. punctata* Thunb.

61. Ficus leucantatoma Poir. Should be called *F. septica* Burm. f.

70. Ficus villosa Bl. May be easily distinguished from the other Javanese species belonging to the same group by its densely patently villous receptacles crowned by a tubiform 1—2 mm long beak which is hairy on the inner side. This beak is often concealed by the long hairs on the top of the receptacle.

73. Ficus diversifolia Bl. Should be called *F. deltoidea* Jack. The leaves of the Javanese specimens show large brown spots in some of the nerve-axils beneath. The female receptacles contain but few flowers with conchiform thick-fleshy tepals.

76. Ficus toxicaria L. Should be called *F. padana* Burm. f.

78. Ficus fulva Reinw. ex Bl. This is the species of which Treub (Ann. Jard. Bot. Buitenzorg, Serie 2, III, pp. 124—154) described the apogamy under the wrong name of *F. hirta* Vahl.

79. Ficus alba Reinw. ex Bl.
80. Ficus leucoptera Miq.
81. Ficus tricolor Miq.

These 3 species should be united and called *F. grossularioides* Burm.f.

NOTES ON THE FLORA OF JAVA, IV

by

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(Issued 1. VI. 1948)

The "Notes on the Flora of Java" I and II were published in Bull. Jard. bot. Buitenz., Sér. III, Vol. XVI², 107—110 (1939) and in Blumea V, No. 3, 490—525 (1945).

Next to these the present paper has two other precursors published under different titles but serving entirely the same purpose, which exists in the publishing of all the observations (including new species and nomenclatorial changes) made during the preparation of a Flora of Java under the direction of Dr C. A. Backer (see introduction to Notes II).

In the following text the emergency edition of the Flora of Java (as far as published) has been quoted, for instance, as: N. Fl. III, fam. XXV, 12 which means Noodflora, fascicle III, family XXV, page 12. Besides, one of Backer's former publications is sometimes mentioned, viz. his "Schoolflora voor Java", 1911. It is quoted as Sch.fl., followed by the page-number.

It should be emphasized that, while elaborating the Flora of Java during the waryears, much material was wanting and not to be had, especially that from Herbarium Bogoriensis.

TILIACEAE, N. Fl. IVb, fam. CV (*Elaeocarpus*).

(*For the other genera see Notes II*).

Elaeocarpus littoralis T. et B. ex Kurz in Journ. As. Soc. Beng. XLIII, II, 132 (1874); Pierre, Flora for. de Coch. obs. ad t. 141 (1880—'99); Koord. et Val., Bijdr. Booms. Java V, 421 et 423 (1900); N. Fl. IVb, fam. CV, 5; Sch.fl. 158 and

Elaeocarpus pierrei Koord. et Val., l. c. 421 et 424; N. Fl., l. c. 6; Sch.fl. 159 — *Elaeocarpus dentata* Reinw. ex Pierre, l. c., non Vahl (1790—'94); Koord. et Val., l. c. I, 247 (1894).

The differences between *E. littoralis* and *E. pierrei* are, according to Pierre, Koorders and Valeton and Backer:

	littoralis	*pierrei*
1. Sepals	shortly pubescent inside	nearly glabrous inside
2. Petals	6—8-lobed at the apex	3—4-lobed at the apex
	each lobe bidentate	each lobe 1—3-cleft
3. Leaves	obovate-oblong	(obovate-)oblong- lanceolate
	cuneate at base	acuminate, attenuate at base
	obtuse or rounded at the apex	obtuse
4. Racemes	shorter than the leaves	nearly as long as the leaves
5. Anther-tails	ca. as long as the anthers (3—4 mm)	shorter than tho anthers (1½—2½ mm)
6. Carina of sepals	glabrous inside	hairy inside at the base
7. Filaments	glabrous	hairy
8. Roots	prop- and respiratory roots	no such roots

The differences, given in literature, do not cover each other and, in my opinion, are insufficient to keep the two species separate; intermediate forms occur. Among the material there were two specimens, showing the characters of *E. littoralis*, though having been collected in a mountain jungle. On the other hand, I saw two specimens of *E. pierrei*, one of which was collected below 650 m alt. and the other on the bank of a lake. The presence or absence of respiratory- and proproots could not be ascertained from herbarium-material and moreover may not be considered a criterion since plants may or may not form these, according to the nature of their habitat. The distinguishing marks 2 and 5 seem to me the best but I have the strong conviction that, as a matter of fact, the two species are identical, the phaenotype varying in accordance with habitat.

Elaeocarpus adenopus Miq., Fl. Ind. Bat. I, II, 209 (1859); Hochr., Pl. Bog. Exsicc. 26 (1904) and

Elaeocarpus longifolia Bl., Bijdr. 120 (1825); N. Fl. IV b, fam. CV, 8; Sch.fl. 161.

In *E. longifolia* I observed the following character: Stipules large, ¾—1¾ cm long, ½—1¼ cm broad, circular-ovate-oval, caducous. According to Hochreutiner this character belongs to *E. adenopus* Miq. and distinguishes this species from *E. longifolia* Bl. Hallier, however, noted on the label of Hochreutiner in the Rijksherbarium that these stipules likewise occur in *E. longifolia*. I was not able to study this question thoroughly.

Elaeocarpus floribunda Bl., Bijdr. 120 (1825); N. Fl. IVb, fam. CV, 8; Sch.fl. 161 and

Elaeocarpus glabra Bl., l. c. 122; N. Fl., l. c. 9; Sch. fl. 161.

Among the specimens of *E. glabra* in our collection occurred *E. floribunda* and *E. longifolia* Bl. as well as *E. glabra* itself. It would seem that even Blume himself could not properly distinguish between his species. Yet, *E. longifolia* can be distinguished clearly by its anther-tails. *E. floribunda* and *glabra* are very closely allied. Regarding almost all characters I found intermediate forms. The crystal-lumps [1]) occur not only in *E. floribunda* but can be found likewise in *E. glabra*, judging from its fruits.

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[1]) In several *Elaeocarpus*-species all herbaceous parts show, when dried, numerous small swellings which are filled up by tiny crystal-lumps.

In *E. floribunda* the fruit is nearly smooth or shallowly grooved, the ovary densely puberulous and the plant in general is more delicate, smaller and more slender. In *E. glabra* the fruit is deeply grooved or has strong tubercles, the ovary is sparingly hairy and the plant in general is coarser and larger, especially as regards pedicels and flowers. However, in all these characters intermediate forms occur.

Elaeocarpus stipularis Bl., Bijdr. 121 (1825); Masters in Hook., Fl. Brit. Ind. I, 404 (1875); Koord. et Val., Bijdr. Booms. Java I, 251 (1894) et V, 419 et 422 (1900); N. Fl. IVb, fam. CV, 7; Sch.fl. 162 — *Elaeocarpus tomentosa* Bl., l. c. — *Elaeocarpus fissistipula* Miq., Fl. Ind. Bat. I, II, 210 (1859).

Backer, Hallier (as appears from his additions on the labels in the Rijksherbarium and in our copy of the Kew Index) and Koorders and Valeton in part V of their Bijdr. (not yet in part I) consider *E. stipularis* and *tomentosa* to be identical. In part I Koorders and Valeton mention (see also Masters) that *stipularis* always possesses 3-celled ovaries and untufted anthers, *tomentosa*, on the contrary, 5-celled ovaries and tufted anthers. I myself found among my material (among which authentic material of Blume) anthers without and with tiny tufts and saw a few 3-celled and two 4-celled ovaries. The fruits I saw were 1- and 2-celled, Masters also says 1-celled, Valeton mentions 3-celled ovaries, Roxburgh 5-celled ones. I also consider the two species identical, with 3—5-celled ovaries and 1—5-celled fruits.

Elaeocarpus oxypyren Koord. et Val., Bijdr. Booms. Java V, 419 (1900); N. Fl. IVb, fam. CV, 8; Sch.fl. 160 — *Elaeocarpus serrata* Bl., Bijdr. 119 (1825), non L. (1753) — *Elaeocarpus acuminata* Koord. et Val., l. c. I, 258 (1894), non Wall. ex Clarke in Hook., Fl. Brit. Ind. I, 406 (1875).

E. serrata Bl., of which I saw a specimen most probably named by Blume himself, is considered by me identical with *E. oxypyren* Koord. et Val. but not with *E. serrata* L. I follow herein Koorders and Valeton, despite the fact that I did not see the type of the last-named species but only the material in our collections.

E. serrata L. originates from Continental Asia and differs from *E. serrata* Bl. and *oxypyren* Koord. et Val. by its smaller, obovate leaves which are more or less accumulated at the twigs' ends, by the nearly glabrous petals and by the very long-tufted anthers.

Elaeocarpus obtusa Bl., Bijdr. 123 (1825); N. Fl. IV b, fam. CV, 5; Sch.fl. 159 — *Elaeocarpus holosericeus* Bl., in sched.

The points of difference with *E. obtusa*, mentioned by Blume on the label of *E. holosericeus* (written by himself) are not essential.

Elaeocarpus (*Monoceras?*) **palembanica (-um)** Miq., Sum. 408 (1862).

Koorders and Valeton (Bijdr. Booms. Java V, 421, 1900) combine this species with *E. griffithii* Mast. (recte A. Gray!). I saw the type of Miquel (*3809 H. B.*, Toeboean, Ogan oeloe, Palembang) but it has, just like the other specimens of this species, only fruits. Hence it is impossible to ascertain whether the anthers are tailed or tufted. But judging from its fruits the species surely does not belong to the untailed group from Java. For the same reason I am not sure that the Javanese specimen *Hort. Bot. Utr. 43572* has to be identified with the present species, or with *E. petiolata*

(Jack) Wall. or *E. griffithii* A. Gray; leaves and fruits are not sufficient to decide this question. The same difficulties exist regarding the numbers *Kds. 33897* and *Vincent 4667*. The flowers of the first-named specimen are those of *E. oxypyren* and probably do not belong to the vegetative parts.

Elaeocarpus petiolata (Jack) Wall. ex Steud. (non A. Gray), Nom. ed. II, I, 545 (1840); Koord. et Val., Bijdr. Booms. Java V, 420 (1900); N. Fl. IVb, fam. CV, 4; Sch.fl. 158 — *Monocera petiolata* Jack in Malay Misc. I, n.v. 43 (1820) — *Elaeocarpus resinosa* Bl., Bijdr. 122 (1825); Koord. et Val., l. c. I, 254 (1894).

Elaeocarpus sphaerica (Gaertn.) K. Schum. in Engl. et Prantl. Natürl. Pflanzenfam. III, 6, 5 (1890); N. Fl. IVb, fam. CV, 7; Sch.fl. 162 — *Ganitrus sphaerica* Gaertn., Fruct. II, 271, t. 139 (1788—1807) — *Elaeocarpus ganitrus* Roxb., Hort. Beng. 42 (1814) n. n.; Fl. Ind. II, 592 (1824); Koord. et Val., Bijdr. Booms. Java V, 419 (1900).

Aceratium oppositifolium DC., Prod. I, 519 (1824); N. Fl. IV b, fam. CV, 9 — *Elaeocarpus oppositifolia* (DC.) Miq., Fl. Ind. Bat. I, II, 211 (1859) — *Elaeocarpus edulis* T. et B. in Tijdschr. Nederl. Indië XXVII, 39 (1864); Sch.fl. 160.

MELIACEAE, fam. CXLVIII.

Toona sureni (Bl.) Merr., Interpr. Rumph. Herb. Amboin. 305 (1917) — *Swietenia sureni* Bl., Cat. Gew. Buitenzorg 27 (1823) — *Cedrela febrifuga* Bl., Bijdr. 180 (1825); Koord. et Val., Bijdr. Booms. Java III, 197 (1896); Sch.fl. 218 — *Cedrela teijsmanni* Hassk., Hort. Bogor. I, 133 (1858) — *Cedrela inodora* Hassk., l. c. 131.

I did not see the types of *C. teijsmanni* and *inodora* Hassk. but I examined the specimen *Kds. 4866* of *C. teijsmanni* (without flowers), cited by Koorders and Valeton. They rightly say that the species differs from *C. febrifuga* Bl. only by its remarkably densely puberulous leaves. Most probably it is a form of *C. febrifuga*. Even in the specimen *Kds. 4866* one can observe how the indumentum of the underside of the leaves is apt to disappear. Besides, I found a specimen under the name of *C. febrifuga* Bl., var. *velutina* Koord. et Val., which perfectly accorded with *Kds. 4866*.

Concerning *C. inodora* Hassk., also Koorders and Valeton declare to be hardly able to distinguish this species from *C. febrifuga*. They mention the glabrous petals, the leaves already in a young state perfectly glabrous and the white heart-wood as distinguishing marks. Hochreutiner (Pl. Bog. Exsicc. 72, 1904) says that the distinguishing marks, mentioned by Hasskarl, fit entirely and that the fruits have fewer lenticels and no spongious tissue inside of the valves. The last-named characters I likewise observed in *C. febrifuga*. Moreover, also glabrous petals and leaves occur in this species. The only available specimen of *C. inodora* seemed to me identical with *C. febrifuga*.

From the descriptions of Hasskarl *C. toona* Roxb., *febrifuga* and *inodora* Hassk. can be hardly kept apart; they pass into each other.

Toona sinensis (Juss.) Roem., Syn. Hesper. 139 (1846) — *Cedrela sinensis* Juss. in Mém. Mus. Par. XIX, 255, 294 (1830); C.DC. in DC., Monog. Phan. I, 743 (1878); Sch.fl. 219 — *Cedrela serrata* Royle, Illustr. Bot. Himal. 144, t. 25 (1839); C.DC., l. c. 742; Koord. et Val., Bijdr. Booms. Java III, 204 (1896) — *Toona serrata* (Royle) Roem., l. c. — *Cedrela serrulata* Miq., Sum. 508 (1862).

C. de Candolle gives as a distinction between *C. serrata* Royle and *C. sinensis* Juss. that the former has only 5 stamens and the second 5 stamens and 5 staminodes. This cannot be correct, since Royle himself mentions in his original description 5 stamens and 5 staminodes. The explication of this discrepancy lies in the fact that the number of staminodes varies from 0 to 5.

Again, Roemer gives as a distinction between the same two species that the first one has paripinnate, the second imparipinnate leaves. Jussieu also mentions in his original description imparipinnate leaves, but Backer, C. de Candolle, Koorders and Valeton all say paripinnate. Because of the absence of the type of *C. sinensis* I could not decide this question and have kept close to the opinion of the last-named authors, which fitted in with our material. I may add, that formerly the pari- or imparipinnateness of leaves was gathered from the total number of leaflets; nowadays only the leaf-apex is taken into consideration.

Xylocarpus granatum Koen. in Naturf. XX, 2 (1784); A. Juss., Mém. Mel. 92, t. 20, n. 22 (1830) — *Carapa obovata* Bl., Bijdr. 179 (1825); C.DC. in DC., Monog. Phan. I, 718 (1878); Koord. et Val., Bijdr. Booms. Java III, 189 (1896); Sch.fl. 217 and

Xylocarpus moluccensis (Lmk.) M. Roem., Syn. Hesper. 124 (1846) — *Carapa moluccensis* Lmk., Encycl. I, 621 (1785); C. DC., l. c. 719; Koord. et Val., l. c. 193; Sch.fl. 217.

As regards these species I suppose that a confusion and interchange by the different authors has taken place concerning the character of the incision of the teeth of the staminal tube. The following statement gives the opinion of the different authors:

	C. obovata	*X. granatum*	*X. moluccensis*
Backer:	acutely bifid =	acutely bifid	entire or lobed
Adelbert:	irregularly lobed *type*	emarginate 1) *original description*	bifid or with specimens, affected by insects irregularly lobed *specimens from original country*
Kds.-Val.:	irregularly lobed	?	entire
Juss.:	?	bifid =	bifid
C. DC.:	subrounded	bifid =	bifid

1) This is mentioned by Koen. for the filaments by which name he indicated the teeth of the staminal tube. The staminal tube itself was called nectarium by him.

The notes in italics indicate from where I got my observations.

The = sign indicates which species have been considered identical.

I could not make out with perfect certainty how far these three species are identical but I assume that *C. obovata* = *X. granatum*, particularly so since also Merrill looks upon them as identical on account of the obovate, rounded leaves.

Turraea humilis (Blanco) Merr. in Philipp. Gov. Lab. Bur. Bull. XXVII, 30 (1905); Spec. Blanc. 208 (1918); Enum. II, 359 (1923) — *Plagianthus humilis* Blanco, Fl. Filip. ed. I, 526 (1837) — *Turraea pumila* Benn., Pl. Jav. Rar. I, 183 (1840); Sch.fl. 200.

The two specimens, cited by Merrill for *T. humilis* and which are represented in our collection, agree perfectly with the Koorders specimens of *T. pumila* (no type). Again, the original description of *Pl. humilis* also fits in with that of *T. pumila* except for some inaccuracies (especially the number of cells of the ovary). Merrill considered in his original description of *T. humilis* both species identical; afterwards (in Spec. Blanc.) he kept them apart and finally he wrote in his Enum.: "= *T. pumila* F. Vill. non? Benn.". Personally, I consider the two species identical.

Melia dubia Cav., Diss. VII, 364 (1789); Sch. fl. 201 — *Melia composita* Willd., Sp. pl. II, 559 (1799); Koord. et Val., Bijdr. Booms. Java III, 9 (1896) — *Melia candollei* Juss. in Mém. Mus. Par. XIX, 258 (1830) — *Melia bogoriensis* Koord. et Val., l. c. 18.

Melia sempervirens Sw., Prod. Veg. Ind. Occ. 67 (1788).

Of this species I had neither type nor original description at my disposal. It is mentioned by Swartz for Jamaica in a second description (Fl. Ind. Occ. II, 737, 1800). A specimen from this locality, examined by me, agreed entirely with *M. sambucina* Bl. (a species identified with *M. azedarach* L.), which is exactly what the Kew Index indicates.

However, in our collection there is also a form of *Melia* with deeply incised leaflets, considered by Backer to be *M. sempervirens* Roxb. (Sch.fl. 202), though described by Roxburgh as *M. sempervirens* Willd. (Fl. Ind., Carey-ed. II, 395, 1832), and by Willdenow as *M. sempervirens* Sw. (Sp. pl. II, 559, 1799). The form in question agreed perfectly with the description by Backer, fairly well with that by Roxburgh, less well with that by Willdenow (who speaks of "foliola profundius et magis inaequaliter *serrata*" [1]) and least of all with that by Swartz himself (who speaks only of "inaequaliter *serrata*" [1]). The description by Swartz agrees better with *M. sambucina* Bl., a fact already stated above.

We have to examine whether *M. sempervirens* Sw. is indeed identical with *M. sambucina* Bl. and *M. azedarach* L. and whether the form with deeply incised leaflets is *M. sempervirens* Sw. or a separate species. In the last case, however, it would be illegitimate to call it *sempervirens*.

Having no types, I could not examine this and other questions thoroughly. In the elaboration of the Flora of Java I have kept for the moment the form with deeply incised leaflets under the name of *M. sempervirens* Sw., not identifying it with *M. azedarach* L. Likewise I have classed the remaining material for the time being in *M. azedarach* L. and *M. dubia* Cav., also without having seen any types.

Antelaea azadirachta (L.) Adelb., nov. comb. — *Melia azadirachta* L., Sp. pl. 385 (1753) — *Antelaea javanica* Gaertn., Fruct. I, 277 (1788) [2] —

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[1] Italics mine (Adelbert).

[2] Hallier (Rec. Trav. Bot. XV, 33, 1918) wrongly reduced this species to *Melia composita* Willd., from which it can be distinguished at once by its 5-celled ovary.

Azadirachta indica Juss. in Mém. Mus. Par. XIX, 221 (1830); Koord. et Val., Bijdr. Booms. Java III, 21 (1896); Sch.fl. 202.

Sandoricum koetjape (Burm.) Merr. in Philipp. Journ. Sc. Bot. VII, 237 (1912).

Of this species I found two specimens with serrate leaves, a character nowhere mentioned in literature.

Dysoxylum gaudichaudianum (A. Juss.) Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 15 (1868); C.DC. in DC., Monog. Phan. I, 518 (1878) — *Didymocheton gaudichaudianum* A. Juss. in Mém. Mus. Par. XIX, 231 (1830) — *Turraea decandra* Blanco, Fl. Filip. ed. I, 347 (1837); Merr. in Philipp. Gov. Lab. Bur. Bull. XXVII, 30 (1905) — *Dysoxylum amooroides* Miq., l. c. 16; C. DC., l. c.; Koord. et Val., Bijdr. Booms. Java III, 84 (1896); Sch.fl. 203.

Two specimens of *Dysoxylum gaudichaudianum* of Zollinger (no type) and the original description of *Didymocheton gaudichaudianum* all agreed perfectly with *D. amooroides* (type examined). Koorders and Valeton do not mention *Dysoxylum gaudichaudianum* at all, C. de Candolle for a reason unknown to me keeps the species separate, Miquel also keeps them apart but copies the description and adds: "non vidi". I consider them identical.

Turraea decandra Blanco, judged from the original description, agrees wholly with *D. amooroides*. Merrill also identifies the two species but only because of Perkins recognizing two specimens of *T. decandra* as *amooroides*.

Dysoxylum alliaceum Bl., Bijdr. 172 (1825); Koord. et Val., Bijdr. Booms. Java III, 47 (1896); Sch.fl. 203 — *Dysoxylum fraternum* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 25 (1868); Koord. et Val., l. c. 54; Sch.fl. 204 — ? *Dysoxylum glabrum* C. DC. in DC., Monog. Phan. I, 483 (1878); Koord. et Val., l. c. 53; Sch.fl. 204 — ? *Dysoxylum nagelianum* C. DC., l. c. 504; Koord. et Val., l. c. 55; Sch.fl. 204.

Of *D. fraternum* Miq. four specimens of Junghuhn were at hand, two of which, named by Miquel and with localisation "Java?" (as mentioned in the original description), I choose for syntype. I consider this species identical with *D. alliaceum* Bl. It is very variable, the flowers may be 4—5-merous and contain 5—10 anthers. All types could be examined.

Of *D. nagelianum* and *glabrum* there was no material available. Hence I am not quite sure but, like other authors, I have got the strong impression that these species are nothing but forms of *alliaceum*. The former differs especially by its entirely glabrous ovary and its externally glabrous disc, the second by its on the outside finely and shortly hairy calyx and its on both sides hairy staminal tube.

Dysoxylum sericeum (Bl.) Adelb., nov. comb. — *Azedarach ramiflorum* Noronh., n. n. in Verh. Batav. Gen. V, ed. I, Art. IV, 5 (1790) — *Epicharis cauliflora* Bl., Bijdr. 166 (1825) — *Epicharis sericea* Bl., l. c. — *Dysoxylum ramiflorum* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 10 (1868); Koord. et Val., Bijdr. Booms. Java III, 39 (1896); Sch.fl. 205.

A combination *ramiflorum* (Noronh.) Adelb. would be inadmissable because of the n. n. of Noronha; the combination *cauliflorum* (Bl.) Adelb. because of there existing already a *Dysoxylum cauliflorum* Hiern. in Hook. f., Fl. Brit. Ind. I, 549 (1875).

Dysoxylum caulostachyum Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 12 (1868); Koord. et Val., Bijdr. Booms. Java III, 34 (1896); Sch.fl. 205.

It did not seem correct to me to combine this species with *D. ramiflorum* Miq. (types of both extant) because of the difference in inflorescence and in indumentum of the calyx being too conspicuous and the want of intermediate forms. All other characters, however, are almost perfectly the same. Hence, when sterile, the species *caulostachyum, ramiflorum* and *densiflorum* are indistinguishable.

Dysoxylum excelsum Bl., Bijdr. 176 (1825); Koord. et Val., Bijdr. Booms. Java III, 56 (1896); Sch.fl. 207 — *Dysoxylum lampongum* Miq., Sum. 503 (1860), exclus. var. β — *Dysoxylum excelsum* Bl., var. *hasseltii* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 20 (1868) — *Dysoxylum macrothyrsum* Miq. in Ann. Mus. Bot. Lugd. Bat. l. c. — *Dysoxylum hasseltii* (Miq.) Koord. et Val., l. c. 64 — *Dysoxylum excelsum* Bl., var. *parvifolium* Koord. et Val., l. c. 61.

A variable species! The distinction between *D. hasseltii* and *D. excelsum* seemed to me untenable after having studied the types, because of the presence of a series of intermediate forms.

Koorders and Valeton mention also a variety *parvifolium* of *D. excelsum* which, as they say, differs especially by its panicles composed of 3-flowered cymes. In the very poor type this indeed is the case but also in specimens of the true *D. excelsum* this character can be observed. And two specimens, determined by Koorders and Valeton as var. *parvifolium,* did not show the character at all. Judging from the very poor material I see no reason to separate the variety from the typical form.

Finally, I found among the material of *D. excelsum* some specimens (among which one of the syntype of Blume!) which rather deviate from the norm and on which perhaps a variety could be based. Because of the fact that only one of these specimens possesses flowerbuds, I refrained from taking a definite decision. The flowers are 5-merous; calyx and corolla entirely glabrous; staminal tube sparingly hairy on both sides; anthers 10; disc sparingly pilose on both sides; ovary 3-celled, sparingly hairy; style with some hairs at the base; stigma cylindrical. Primary lateral nerves ecarinate, secondary ones less conspicuous cross-barred and with more than 2 mm interspace.

Koorders and Valeton identify *D. macrothyrsum* Miq. with *D. excelsum.* In the original description of *macrothyrsum* Miquel mentions as a synonym: *D. lampongum* Miq., exclus. var. β. And *lampongum* has been validly described! If so, Miquel should have reserved the name *macrothyrsum* for that var. β of *lampongum* and his *macrothyrsum* should be *lampongum. Lampongum* itself appeared to be identical with *excelsum* and the said var. β with *D. arborescens* Miq. The synonymy has to be as mentioned above and under *D. arborescens.*

Dysoxylum arborescens Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 24 (1868); Koord. et Val., Bijdr. Booms. Java III, 76 (1896); Sch.fl. 207 — *Goniocheton arborescens* Bl., Bijdr. 177 (1825) — *Dysoxylum lampongum* Miq., var. β Miq., Sum. 503 (1860) — *Dysoxylum kunthianum* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 13 (1868) — *Dysoxylum halmaheirae* C. DC. in DC., Monog. Phan. I, 488 (1878) — *Dysoxylum rubrum* Merr. in Philipp. Gov. Lab. Bur. Bull. XXXV, 32 (1906).

Dysoxylum multijugum (Bl.) Adelb., nov. comb., non Arn., n. n. — *Heynea multijuga* Bl., Bijdr. 168 (1825) — *Dysoxylum cyrtobotryum* Miq., Sum. 504 (1860), non var. *β, borneensis* Miq. — *Dysoxylum blumei* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 25 (1868); Koord. et Val., Bijdr. Booms. Java III, 73 (1896); Sch.fl. 208.

The oldest name of this species is *Heynea multijuga* Bl. When Miquel classed the species in the genus *Dysoxylum* he changed the specific epithet into *blumei* because of there existing already a *D. multijugum* Arn. This name being a n. n., the specific epithet *multijugum* can be maintained.

D. cyrtobotryum Miq. has already proved to be identical with the species cited above. The var. *borneensis,* however, which has not been mentioned for Java, differs so much from *D. multijugum* that I take it to be a separate (new?) species. In this variety the fruits are 4-celled, obovoid, 4-lobed, with indented apex. In *multijugum* they are 1-celled (?), spool- or pearshaped.

Among the Leyden material of *D. multijugum* there occur some specimens (*Kds. 23803, 23493* and *7565, Bakhuizen van den Brink 3556, Dakkus 250* and *Backer 25453*) which considerably differ from the typical form, especially by the far more conspicuous venation of the leaves, the rather elevated and carinate primary lateral nerves of which several were bifurcate at the end, the smaller, caudate leaves and the more glabrous rachides of the leaves. The specimens seem to form at least a new variety, perhaps even another (new?) species. I could not yet take a decision because of the specimens being sterile.

Dysoxylum vrieseanum C. DC. in DC., Monog. Phan. I, 491 (1878); Koord. et Val., Bijdr. Booms. Java III, 72 (1896); Sch.fl. 207.

A species, collected in Java a long time ago of which there seems to be preserved no material at all. It was said to differ from *D. multijugum* especially by its racemes, being approximately as long as the whole leaf (in *multijugum* shorter), the acute teeth of the calyx (in *multijugum* obtusely triangular), the disc being glabrous on both sides and the staminal tube being finely hairy on both sides. C. de Candolle saw in the Kew Herbarium a specimen, collected by De Vriese in Java.

Dysoxylum biloculare Koord. et Val., Bijdr. Booms. Java III, 95 (1896).

Of this species 3 specimens were at hand: *Kds. 5027, 10979* and *4978,* sterile and with the leaves cut off. They resemble a good deal the exceptional specimens of *D. multijugum* (Bl.) Adelb., mentioned above but I did not observe any bifurcate nerves and the conspicuous venation shown by *multijugum.* Both forms will have to be compared later on. I failed to recognize the characteristic features of the italicized parts in the original description which may be meant as particularly distinguishing marks. Further, the inflorescences are panicles!

Chisocheton junghuhnii (Miq.) Adelb., nov. comb. — *Schizochiton junghuhnii* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 30 (1868) — *Chisocheton junghuhnii* Miq. ex Kew Index I, 517 (1895).

In the Leyden collection a sterile specimen is found, originating from "Herb. Reinwardt", which is probably *Ch. junghuhnii* (Miq.) Adelb. It cannot be decided whether the indication "Java" on the label is reliable.

Most probably this species (of which the type from Sumatra was present) is identical with *Ch. sandoricocarpus* Koord. et Val., or the latter may be a variety of the former. If so, *junghuhnii* is the oldest name. I could not observe any other difference than that *junghuhnii* has more obovate, smoother leaves with conspicuously longer, narrowly cuneate, acute bases.

In the Kew Index several species of *Chisocheton* are erroneously mentioned to be published by Miquel in the Annales (l. c.). They all are mentioned there under the generic epithet *Schizochiton*. Therefore, the new combinations, given by the Kew Index, are invalid and herewith are legitimated by me:

Chisocheton amabilis (Miq.) Adelb., nov. comb. — *Schizochiton amabile* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 27 (1868).

Chisocheton ceramicus (Miq.) Adelb., nov. comb. — *Schizochiton ceramicum* Miq., l. c. 29.

Chisocheton paucijugum (Miq.) Adelb., nov. comb. — *Schizochiton paucijugum* Miq., l. c. 30.

Chisocheton spectabilis (Miq.) Adelb., nov. comb. — *Schizochiton spectabilis* Miq., l. c. 29.

Lansium domesticum Corr. emend. Jack in Trans. Linn. Soc. XIV, I, 115 (1823); Koord. et Val., Bijdr. Booms. Java III, 180 (1896); Sch.fl. 215 — *Lansium javanicum* Koord. et Val. ex Moll. et Jansonius, Mikrographie des Holzes II, 176 (1908).

Amoora grandifolia (Bl.) Walp., Rep. I, 429 (1842) — *Aphanamixis grandifolia* Bl., Bijdr. 165 (1825) — *Amoora aphanamixis* Roem. et Schult., Syst. VII, 1621 (1829—'30); Koord. et Val., Bijdr.-Booms. Java III, 119 (1896); Sch.fl. 33 — *Amoora spec.* Koord. et Schum., Syst. Verzeichn. I, fam. 140, 33 (1910—'13).

Amoora trichanthera Koord. et Val., Bijdr. Booms. Java III, 123 (1896); Sch.fl. 216.

In the description given by Koorders and Valeton some characters are mentioned, which, even after repeated examinations, I could not observe, viz. petals connate at base, staminal tube shortly hairy inside, ovary small, triangular, stigmas 3, straight. It should, however, be stated that I had only one flowering specimen at my disposal, which moreover was not the type.

Aglaia heptandra Koord. et Val., Bijdr. Booms. Java III, 132 (1896); Sch.fl. 210.

Up to now the fruits of this species were unknown. When the fruiting specimen: *Herb. Jungh. 45, Plantae Jungh. ineditae 207* is indeed *A. heptandra,* then the berries are densely stellately pubescent, 1-celled, 1-seeded, with woody pericarp, ca. 3 cm long and 2½ cm broad; seed ovoid, ca. 2 mm long.

Aglaia angustifolia Miq., var. β, **horsfieldiana** C. DC. in DC., Monog. Phan. I, 617 (1878); Koord. et Val., Bijdr. Booms. Java III, 173 (1896); Sch.fl. 211.

Backer says of this species: "Collected in Java a very long time ago", Koorders and Valeton mention: "wanting in Herb. Kds.". In the Leyden Herbarium there are some Javanese specimens under that name but they appeared to be juvenile forms of *Sapindus rarak* L. I have struck out the species for Java.

Aglaia sulingi Bl., Bijdr. 170 (1825); Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 44 (1868); Koord. et Val., Bijdr. Booms. Java III, 146 (1896); Sch.fl. 213.

This species has, after Blume discovered it on Mount Soeling near Buitenzorg, never been recollected and has become somewhat obscure because of the absence of a clearly assignable type in Herb. Kds. Only Miquel remained as indicator of what *A. sulingi* really was. His description suggests originality. Besides, one of the two specimens in our collection bears his handwriting. This specimen I have chosen for a lectotype.

Aglaia latifolia Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 42 (1868); Koord. et Val., Bijdr. Booms. Java III, 138 (1896); Sch.fl. 214 — *Aglaia mucronulata* C. DC. in DC., Monog. Phan. I, 601 (1878); Koord. et Val., l. c. 142; Sch.fl. 214 — *Aglaia euryphylla* Koord. et Val. in Koord. et Schum., Syst. Verzeichn. I, fam. 140, 37 (1911) n. n.

De Candolle mentions for *A. mucronulata* a 1-celled ovary. This statement seems to have been based upon a wrong observation because I had the type at hand and saw a 3-celled, 3-seeded ovary.

Aglaia elaeagnoides (Juss.) Bth., Fl. Austral. I, 383 (1863); Koord. et Val. Bijdr. Booms. Java III, 135 (1896); Sch.fl. 214 — *Aglaia roxburghiana* Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 41 (1868); Koord. et Val., l. c. 147; Sch.fl. 214.

Aglaia argentea Bl., Bijdr. 170 (1825); Koord et Val., Bijdr. Booms. Java III, 160 (1896); Sch.fl. 215.

Very variable species of which several forms can be distinguished as varieties. As regards Java the following remarks might be made: Even the forma typica is variable in many respects but in this case the characters pass into each other to such a degree that splitting up was neither possible nor useful. I saw specimens with densely lepidote and with nearly glabrous petals, anthers inserted at the base and at the top of the staminal tube (both in the syntype), capitate stigmas on style and sessile stigmas, conical and cylindrical stigmas, an old specimen with 3—5 leaflets per leaf, etc.

I have dropped the var. *cordulata* C. DC. (in DC., Monog. Phan. I, 618 (1878); Koord. et Val., l. c. 161). The only distinguishing mark, given by De Candolle is the cordate base of the leaflets but in the description of the typical form he also mentions: leafbase subcordate. Koorders and Valeton describe the leafbase as more or less symmetrical and rounded. This is not right, the type of Blume also possesses cordate leafbases.

The varieties *angustata* Miq. (Fl. Ind. Bat. I, II, 543 (1859); Koord. et Val., l. c. 164) and *multijuga* Koord. et Val. (l. c. 165) I have not kept apart any longer as the points of difference have no varietal value.

Maintained was the var. *splendens* Koord. et Val. (l. c. 166) under which I brought together all specimens with acute to obtuse base of leaflets. Koorders and Valeton mention a 3-celled ovary for this variety (as contrasted with the typical form with 2-celled ovaries) and on account of that and other characters they raised it to specific rank (Icon. Bog., t. XIV, 1901). Because of my material being sterile I could not study these characters but, judging from the variability within the species *argentea*, I am inclined to maintain it as a variety.

As authentic material Koorders and Valeton mention, besides a few specimens from Kds. Herb. (on which the view, given above was based), also the specimen: *Culta in Hort. Bog. III. B. 34.* This specimen, as do some other non-Javanese specimens, looks indeed very different and may perhaps be worthy of another specific or varietal name.

Which of the two groups has to be considered the true species or variety *splendens?* I have, for the moment, considered *splendens* to be a variety of *argentea* based upon the material from Herb. Kds. It is, perhaps, superfluous to mention that there are also intermediate forms between *splendens* and the typical form of *argentea*; leaves with cordate and with acute base may occur on the same plant.

Finally, a new variety, to which my attention was drawn by Dr C. G. G. J. van Steenis, may be mentioned here:

Aglaia argentea Bl., var. **stellati-pilosa** Adelb., nov. var. — Differt a typo paniculis, calycibus (extus), ovariis, baccis, rachidibus foliorum, petiolis, paginis inferioribus foliorum stellato-pilosis (in typo stellato-squamatis). Characteres transitorii existunt.

Java: Noesa Kambangan, Limoes Boentoe, alt? (not higher than ca. 100 m alt.): *Amdjah 210* (fl. on 18-XI-1907): type in Herb. Lugd. Bat. (comm. ex Herb. Hort. Bot. Bog.).

Aglaia acuminatissima T. et B. in Nat. Tijdschr. Ned. Ind. XXVII, 42 (1864); Koord. et Val., Bijdr. Booms. Java III, 175 (1896).

No more than Koorders and Valeton did I see the type and therefore I cannot take a decision as to an eventual identity with *A. aspera* T. et B. Nevertheless I believe they are the same. In any case, all specimens of *acuminatissima* in our collection were *aspera.* I have not kept the species apart for Java.

Aglaia javanica Koord. et Val. ex Koord. in Meded. 's Lands Plantentuin XIX, 381 (1898) n. n.

Type absent. I believe the 3 specimens in our collection are all *A. argentea* Bl., var. *splendens* Koord. et Val.

Aglaia subgrisea Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 54 (1868); Koord. et Val., Bijdr. Booms. Java III, 176 (1896).

Sterile type present. Probably identical with *A. heptandra* Koord. et Val. The specimen deviates by its leaflets being more densely stellately hairy beneath.

Aglaia polyphylla Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 56 (1868); Koord. et Val., Bijdr. Booms. Java III, 175 (1896).

Type extant with flowerbuds far too young for examination. Presumably a juvenile form of *A. longifolia* T. et B.

Aglaia oligocarpa Miq. in Ann. Mus. Bot. Lugd. Bat. IV, 45 (1868).

Type extant, together with two Javanese (?) specimens of Junghuhn. The latter are doubtless identical with the type but I have my doubts about the exactness of the labels, especially because one of them bears the same number as the type from Sumatra. I have dropped the species for Java.

Aglaia winckelii Adelb., nov. spec. — *Ramuli* apice pulverulento-stellato-pilosi (ut in *A. aspera* T. et B. dubiosum an sint pili vel squamuli). *Folia* imparipinnata; rhachis subteres, ut ramuli pilosa, 47½—68 cm; foliola

12—19, oblongo-lanceolata, in parte inferiore rhachidis insuper saepe ovata, in parte superiore insuper obovata, basi nunc aequalia, acuta vel rotundata nunc inaequalia, uno latere anguste cuneata, altero late cuneati-rotundata, apice saepissime valde laesa, sed statu integro probabiliter acuta, obtusa vel acute vel obtuse acuminata, supra glabra, subtus praecipue basi et in nervis pilis stellatis sparsis parvis multiramosis obsessa, integra, papyracea, nervis primariis subelevatis 12—21, nervis secundariis subconspicuis et venis inconspicuis, 8½—25½ cm longa, 2—9 cm lata; petioluli subteretes, ut rhachis foliorum pilosi, 6—27 mm. *Inflorescentiae* permagnae paniculiformes, late ramosae, axillares, pilis stellatis vel squamulis stellatis minimis pulverulentis munitae, 45—76 cm. *Flores* ca. 1½ mm longi (majores quam in *A. aspera* T. et B.); pedicelli ut inflorescentiae pilosi, 1—2 mm. *Calyx* 5-lobatus, extus pilis stellatis parvis munitus, intus glaber; lobi rotundati vel obtusi, ciliati. *Petala* 5, basi connata, ovalia, inaequalia, concava, conniventia, glabra. *Tubus stamineus* basi constrictus, margine irregulariter exsculptus, sine lineis incrassatis, glaber; antherae 5, ovali-oblongae, in parte superiore tubi inclusae, summum extremo apice e tubo exsertae, glabrae. *Ovarium* minimum argenteum, stellato-squamatum; stigma sessile, oblongum, teres, crassum. *Fructus* adhoc ignotus.

Java: W. Java, Priangan, G. Bèsèr near Tjidadap, S. of Tjibeber, ca. 1000 m alt.: *Winckel 322* (fl. on 10-X-1918): type in Herb. Lugd. Bat.; same data: *Winckel 322b*; Priangan, Takoka, ca. 1000 m alt.: *Kds. 39546* (15-III-1902), (distributed as *A. odoratissima* Bl.).

This species belongs to the group of *A. aspera* T. et B. and *A. longifolia* T. et B. It cannot be identified with the former because of the different flower-structure. The flowers of *longifolia* are unknown to me. By the leaves the three species cannot be distinguished. The reason why I have not identified my species with *A. longifolia* is that, though neither Koorders and Valeton nor anybody else describes the flowers of the last-named species, I am not quite sure whether there are not any flowers to be found in Herb. Bog. since the species was formerly cultivated in Hort. Bog. Moreover, the species was collected by Teijsmann on Mount Salak and it is not out of the question that it may be recollected there in future. The best solution seemed to me to describe *A. winckelii* provisionally as a new species.

Walsura trijuga (Roxb.) Kurz. in Journ. As. Soc. Beng. XLIV, II, 148 (1875) — *Heynea trijuga* Roxb., Hort. Beng. 33 (1814) n. n.; in Sims., Bot. Mag. t. 1738 (1815) — *Heynea sumatrana* Miq., Sum. 505 (1860); Koord. et Val., Bijdr. Booms. Java III, 4 (1896); Sch.fl. 217.

SAPINDACEAE, fam. CIL.

Cardiospermum halicacabum L., var. **luridum** (Bl.) Adelb., nov. comb. — *Cardiospermum luridum* Bl. in Rumphia III, 184 (1847).

The variety differs from the typical form only by its larger fruits (ca. 3 cm long, 3½ cm broad; in the typical form 1½—2 cm long, 2—2¾ cm broad).

Allophylus cobbe (L.) Bl. (s. l.) in Rumphia III, 131 (1847); Koord. et Val., Bijdr. Booms. Java IX, 146 (1903); Sch.fl. 261.

In his monography (in Engler, Pflanzenreich, Sapind. I, 1933) Radlkofer kept 6 species out of the numerous synonyms which are related to the complex *A. cobbe*, viz.: *A. cobbe* (L.) Bl. (s. s.); Radlk., l. c. 594; *A. glaber* (Roxb.) Radlk., l. c. 566; *A. racemosus* (L.) Radlk., l. c. 568; *A. javensis* Bl.; Radlk., l. c. 578; *A. sumatranus* Bl.; Radlk., l. c. 586 and *A. timorensis* (DC.) Bl.; Radlk., l. c. 587. These species are more or less distinguishable but their differences are so trivial and moreover nullified by intermediate forms that I suggest to consider them varieties or forms of *A. cobbe* s. l. In our Flora of Java I have united them under that name.

E. J. H. Corner in Gard. Bull. X, 1, 38 (1939) also takes all Malayan forms of *Allophylus* together under the name of *A. cobbe* (L.) Bl. and subdivides that species into 5 varieties, which are, however, distinguished otherwise than the species of Radlkofer.

Sapindus trifoliatus L., Sp. pl. 367 (1753); Radlk. in Engler, Pflanzenreich, Sapind. I, 656 (1933); Sch.fl. 261.

Backer says (in sched.) that the descriptions and materials do not answer the description by Linnaeus. The latter does not say more than: "foliis ternatis". Because of the absence of the type and the statement of 4—6 leaflets by different authors I could not decide whether the determination of our material was right. Radlkofer does not mention anything about it, only: "folia 2—3-juga (interdum 1½-juga)" and further on that he considers the name as not fitting and absurd. For this same reason Vahl had already altered the name into *laurifolius*. However, the leaves inserted near the inflorescences, are often trifoliolate. The specimen seen by Linnaeus may have been incomplete.

Lepisanthes montana Bl., Bijdr. 238 (1825); Koord. et Val., Bijdr. Booms. Java IX, 165 (1903); Sch.fl. 263 — *Lepisanthes sessiflora* Bl. in Rumphia III, 153 (1847); Radlk. in Engler, Pflanzenreich, Sapind. I, 734 (1933).

L. sessiflora is considered by Radlkofer a separate species, differing from *montana* by the membranous leaflets and the sessile flowers. Of both I examined the type and I could ascertain that these characters do not hold good. By Koorders and Valeton the species is identified with *L. blumeana* Koord. et Val. and distinguished from *montana* on account of gibbosities on the scale of the petals, a character also mentioned bv Radlkofer. According to my observations there are indeed little elevations which look like gibbosities but these are nothing else than folds in the scale, such as occur likewise in *L. montana*. Anyhow, they are quite different from the conspicuous horns of *blumeana*.

Lepisanthes blumeana Koord. et Val., Bijdr. Booms. Java IX, 168 (1903); Sch.fl. 263,

Lepisanthes heterolepis Bl. in Rumphia III, 153 (1847); Radlk. in Engler, Pflanzenreich, Sapind. I, 734 (1933) and

Lepisanthes angustifolia Bl., l. c. 154; Radlk., l. c. 735.

I am not yet sure of the identity of these species. Radlkofer unites the two first-named ones, but *L. heterolepis*, of which I saw the type seems to me to agree far better with *L. montana* Bl. (type also extant), especially in the vegetative parts. *L. blumeana*, of which unfortunately the type was not available, possesses typically different leaves. The flowers of *heterolepis* deviated strongly from *montana* as well as from *blumeana*. I had no Javanese material of *heterolepis*, so I have put it aside.

Concerning *L. angustifolia* Bl., Radlkofer keeps this species apart but, judging from the authentic material from Sumatra, I think it very much like *blumeana*, from which it differs only by the leaves. The two Javanese specimens are still more like *blumeana* but as they are sterile, they may also be confounded with *L. pallens* (Bl.) Radlk., a species of which Radlkofer himself thinks that it may be identical with *angustifolia*. Whether the latter is identical with *blumeana* could not be ascertained but in our Flora I have brought all the Javanese material together under the name of *blumeana*.

Otophora amoena (Hassk.) Bl. in Rumphia III, 142 (1847); Koord. et Val., Bijdr. Booms. Java IX, 172 (1903); Sch.fl. 263 — *Otophora spectabilis* Bl., l. c.; Koord. et Val., l. c. 171.

These species are connected by gradual transitions in density of indumentum, number of petals and anthers.

Schleichera oleosa (Lour.) Merr., Interpr. Rumph. Hb. Amb. 337 (1917) — *Pistacia oleosa* Lour., Fl. Cochinch. II, 615 (1790) — *Schleichera trijuga* Willd., Sp. pl. IV, 2, 1096 (1805); Koord. et Val., Bijdr. Booms. Java IX, 177 (1903); Sch.fl. 264.

Xerospermum noronhianum Bl. in Rumphia III, 100 (1847); Koord. et Val., Bijdr. Booms. Java IX, 182 (1903); Radlk. in Engler, Pflanzenreich, Sapind. I, 946 (1933); Sch.fl. 265.

This species is separated by Radlkofer from the other species mentioned by him for Java on account of the fact that it possesses secretory cells beneath the epidermis, a microscopical-anatomical character, useless for a popular flora. The other distinguishing marks were either not sufficiently specifical or unverifiable (fruits were often wanting). Besides, I had little or no material of the species of Radlkofer in question. Therefore I have, in the Flora of Java, brought together all these species, as enumerated below, under the name of *X. noronhianum* Bl., without having the intention to suggest, by doing so, their identity.

X. fallax Radlk. in Fedde, Repert. XVIII, 340 (1922); in Engler, l. c. 942; *X. testudineum* Radlk. in Fedde, l. c.; in Engler, l. c. 941; *X. xanthophyllum* Radlk. in Flora CXVIII—CXIX, 400 (1925); in Engler, l. c. and *X. brachyphyllum* Radlk. in Records Bot. Surv. Ind. III, 3, 348 (1907); in Engler, l. c. 942.

Arytera xerocarpa (Bl.) Adelb., nov. comb. — *Euphoria xerocarpa* Bl., Bijdr. 234 (1825), excl. fructu descripto, qui ad *Xerospermum noronhianum* Bl. pertinet — *Arytera litoralis* Bl. in Rumphia III, 170 (1847); Koord. et Val., Bijdr. Booms. Java IX, 216 (1903); Sch.fl. 269.

Mischocarpus sumatranus Bl. in Rumphia III, 168 (1847); Radlk. in Engler, Pflanzenreich, Sapind. II, 1298 (1934).

Radlkofer mentions this species also for Java, though interrogatively and on flimsy grounds. Considering the slight difference with *M. sundaicus* Bl. it is possible that *M. sumatranus* hides itself in the material of that species. In *M. sumatranus* the primary lateral nerves extend to near the leaf margin and run some way along it before anastomosing conspicuously. Besides, the meshes of the venation are coarser, the disc and anthers hairy, the fruit-stalks twice as long as the fruit proper, the leaves 8—10-foliolate. In *M. sundaicus* the primary lateral nerves keep rather far from the leaf-edge and anastomose much earlier and more conspicuously.

Dodonaea viscosa (L.) Jacq., Enum. pl. carib. 19 (1760); Radlk. in Engler, Pflanzenreich, Sapind. II, 1363 (1934); Koord. et Val., Bijdr. Booms. Java IX, 227 (1903); Sch.fl. 270.

Very variable species of which Radlkofer distinguishes several varieties and forms. For Java he mentions the var. *vulgaris* and of that variety four forms.

At first sight, especially in Java, it seems as if in *D. viscosa* a coastal form and a mountain form can be distinguished on account of the following observations:

1. A remarkable difference in habitat between the two forms.

2. The coastal form is glabrous, possesses ☿ flowers and obovate-spathulate leaves; the mountain form is hairy and has unisexual flowers and elongate-lanceolate leaves.

3. The distinction between coastal and mountain form, based on point 2, seems to correspond with a separation between the forms *repanda* and *burmanniana* of Radlkofer on the one hand and his forms *schiedeana* and *waitziana* on the other.

Yet I believe that the separation in coastal and mountain form can, in general, not be maintained and that the strong divergency between them in Java is only accidental. This I concluded from the following observations:

1. From an examination of non-Javanese material appears that the coastal type can occur also in the mountains and

2. That there are numerous intermediate forms between them.

3. Radlkofer mentions for several of his forms both habitats and the morphological distinction between his forms is not very clean-cut.

However, much material, cited by Radlkofer for Java, was not available, i. a. that from the Buitenzorg Herbarium.

Hence I am of the opinion that a subdivision into varieties and forms, irrespective of habitat is, at least provisionally, preferable to a separation into a coastal and a mountain form, though the habitat may influence the outward appearance.

It is remarkable that the on the whole frequent coastal form has been met with until now, along the N.-coast of Java, only in the surroundings of Batavia and Soebah.

Cubilia cubili (Blanco) Adelb., nov. comb. — *Euphoria cubili* Blanco, Fl. Filip. 287 (1837) — *Cubilia rumphii* Bl. in Rumphia III, 101 (1847) n. 2; Koord. et Val., Bijdr. Booms. Java IX, 143 (1903); Sch.fl. 268 — *Cubilia blancoi* Bl., l. c. n. 1; Radlk. in Engler, Pflanzenreich, Sapind. I, 923 (1933).

This new combination is admissible, being not a complete tautonym.

ANACARDIACEAE, fam. CLIII.

Gluta renghas L., Mant. II, 293 (1767); Koord. et Val., Bijdr. Booms. Java IV, 94 (1896); Sch.fl. 280 — *Gluta velutina* Bl. in Mus. Bot. Lugd. Bat. I, 183 (1850).

Bouea gandaria Bl. in Mus. Bot. Lugd. Bat. I, 204 (1850) — *Bouea macrophylla* Griff., Pl. Cantor 15 (1854); Notul. IV, 420 (1854); Koord. et Val., Bijdr. Booms. Java IV, 98 (1896); Sch.fl. 280.

The paper by Griffith concerning the plants of Dr Cantor, containing the original description of *B. macrophylla, B. burmanica* and *B. microphylla* Griff. has, in my opinion, only been validly published in 1854, in Journ. As. Soc. Beng. In that place the paper is preceded by a note mentioning that "some years before" it had already been printed but, (probably) because of the discontinuation of the larger paper of which it was intended to form part, not published. When we adhere to the year 1854, the synonymy is as mentioned above.

Bouea oppositifolia (Roxb.) Adelb., nov. comb. — *Mangifera oppositifolia* Roxb., Hort. Beng. 18 (1814) n. n.; Fl. Ind. I, 640 (1820 Ed. I or 1832 Ed. Carey?) — *Bouea burmanica* Griff., Pl. Cantor 14 (1854); Koord. et Val., Bijdr. Booms. Java IV, 101 (1896); Sch.fl. 280 — *Bouea microphylla* Griff., l. c. 15; Notul. IV, 423 (1854).

See the remark to the preceding species.

Spondias mombin L., Sp. pl. Ed. I, 371 (1753) — *Spondias lutea* L., Sp. pl. Ed. II, 613 (1762—'63); Koord. et Val., Bijdr. Booms. Java IV, 111 (1896); Sch.fl. 280.

Backer gives this identification in ms.; according to the Kew Index *Sp. mombin* is identical with *Sp. purpurea* L. Merrill (Enum. Philipp. pl. II, 471, 1923) also gives *Sp. purpurea* for the Philippines but without addition of *mombin* or *lutea* as synonyms. Koorders and Valeton mention *Sp. lutea* without the synonyms *mombin* or *purpurea.*

Because of the absence of types and the fact that the different authors either are silent on the matter or contradict each other it was not possible to state exactly what is the relation between these three species. The most probable synonymy is that mentioned above because of the description of *lutea* being fairly well literally the same as that of *mombin.* Presumably Linnaeus has altered the name of his original *mombin.*

Spondias cytherea Sonn., Voy. Ind. II, 222 (1782) — *Spondias dulcis* Forst. f., Prod. 34 (1786); Koord. et Val., Bijdr. Booms. Java IV, 108 (1896); Sch.fl. 281.

Lannea wodier (Roxb.) Adelb., nov. comb. — *Odina pinnata* Rottl. in Ges. Naturf. Fr. Berl. Neue Schr. IV, 209 (1803) n. n. — *Odina wodier* Roxb., Hort. Beng. 29 (1814) n. n.; Fl. Ind. II, 293 (1824 or '32); Koord. et Val., Bijdr. Booms. Java IV, 140 (1896); Sch.fl. 282 — *Haberlia grandis* Dennst., Schluess. Hort. Malab. 30 (1818) n. n. — *Rhus odina* Buch.-Ham. ex Wall., Cat. n. 8475 (1828) n. n. — *Lannea grandis* (Dennst.) Engl. in Engl. et Prantl., Pflanzenfamilien, Nachtr. I, 213 (1897).

Rhus rufa T. et B. in Nat. Tijdschr. Nederl. Ind. XXVII, 52 (1863) — *Melanococca tomentosa* Bl. in Mus. Bot. Lugd. Bat. I, 236 (1850) — *Rhus retusa* Zoll. ex T. et B., Cat. Hort. Bog. 230 (1866); Koord. et Val., Bijdr. Booms. Java IV, 119 (1896); Sch.fl. 282.

It was illegitimate to call the species *tomentosa* because of there existing already a *Rhus tomentosa* L. (1753).

Semecarpus heterophylla Bl. in Mus. Bot. Lugd. Bat. I, 187 (1850); Koord. et Val., Bijdr. Booms. Java IV, 124 (1896); Sch.fl. 284 — *Seme-*

carpus albescens Kurz in Journ. As. Soc. Beng. XL, II, 51 (1871); Koord. et Val., l. c. 129; Sch.fl. 284.

The two species are connected by numerous intermediate forms.

SOLANACEAE, fam. CXC.

Brugmansia candida Pers., Syn. I, 216 (1805); Safford in Smith. Rep., 537—567 (1920); in Journ. Wash. Ac. Sc. XI, 173—189 (1921); Van Steenis in Trop. Nat. XXX, 33—38 (1941).

I have treated the Javanese material of this species, for which Backer mentions a deciduous calyx and nearly linear fruits, and that which might be called *Br. arborea* (L.) Adelb. only under the name of *candida*. According to Safford, *Br. candida* Pers. is not identical with *Datura arborea* L. Because of insufficient material I could not study this question thoroughly. I have, however, the impression that the distinguishing marks, given by Safford, are not conclusive (he himself gives no descriptions and saw perhaps not enough material); on the other hand it is not impossible that the two species are really different, that *D. arborea* also occurs in Java and that the two species have been mixed up. Therefore I mention here the differences, given by Safford:

Corolla longer than 20 cm; edge of limb between the teeth entire or rounded; calyx persistent; fruit oblong (measures?) (*Datura arborea* Ruiz et Pavon, non L.) . . . . **Br. candida** Pers.

Corolla not longer than 17 cm; edge of limb between the teeth cordate or retuse; calyx deciduous; fruit ca. globose, ca. 6¼ cm long and ca. 5½ cm broad (*Datura arborea* L.) . . . . **Br. arborea** (L.) Adelb., non Auct.

Datura ferox L., Diss. Dem. Pl. in Amoen. Acad. III, 403 (1753); Miq., Fl. Ind. Bat. II, II, 666 (1857); Koord., Exkurs. fl. III, 168 (1912); Van Steenis in Trop. Nat. XXX, 36 (1941).

This species, belonging to the same group as *D. stramonium* L., is mentioned by Miquel for Malabar "and other regions of the Netherlands' Indies", in which he was followed by Koorders. According to Backer (Kritiek Exkursionsflora 40, 1913) this record is based on an incorrect determination. There exists not the slightest evidence that this species occurs in Java.

Datura metel L., Sp. pl. 179 (1753) non Auct.; Safford in Smith. Rep. 537—567 (1920); in Journ. Wash. Ac. Sc. XI, 173—189 (1921); Van Steenis in Trop. Nat. XXX, 33—38 (1941).

Because of a mixing up of names the name *D. metel* L. was given by most authors to another species *D. innoxia* Mill. till Safford put an end to this confusion. Since this species might also occur in Java and hide under the material of *D. fastuosa* L. (as the true *D. metel* is called in Java) I may mention here that *D. innoxia* differs from *D. metel* by its rather densely grey-white pubescent stems, petioles, pedicels, leaf nerves (leafs?) and calyx (hairs longer than in *D. metel*), the 10-angulate corolla limb with 10 short little teeth (in *D. metel* mostly 5-lobed with conspicuous incisions between the lobes and 5 rather long points) and the shortly white-hairy fruits with thinner, softer spines.

It should be stated, however, that there exists a densely white-hairy form of *D. metel* too (forma *alba*).

Physalis angulata L., Sp. pl. 183 (1753) — *Physalis pseudo-angulata* Bl., Bijdr. 706 (1825).

The last mentioned species, of which I saw the type, is not identical with *Ph. minima* L. as Backer and the Kew Index supposed.

Capsicum L.

The different species of *Capsicum* are so much alike of form (and of description) that insight into the genus is only possible after monographical study. Till then, the elaboration in the Flora of Java is of comparatively little value, I deemed it sufficient there to classify all Javanese species into two groups under the names of *C. frutescens* L. and *C. annuum* L. I think this classification, in the main, to be correct.

Miquel (Fl. Ind. Bat. II, II, 657, 1857) enumerates many species. It was not possible to study them. I believe that *C. conoides* Mill., cited by him, is identical with *C. frutescens* and that *C. cordiforme* Mill., *C. longum* DC. and *C. tetragonum* Mill. all are *C. annuum*. *C. minimum* Roxb. (material from India) and the lectotype of *C. fastigiatum* Bl., identified with it, are both *C. frutescens*. Of *C. dulce* Hort. (= *tomatiforme* Fingerhuth), *C. bicolor* Jacq. and *C. pyramidale* Mill. no material was at hand.

Like other authors, I consider *C. baccatum* L. a variety of *C. frutescens* with globose fruits and *C. grossum* L. a variety with ovoid-globose fruits of *C. annuum*.

Capsicum violaceum H., B. et K., Nov. Gen. et Sp. III, 49 (1818); Fingerhuth, Monog. Caps. 23 (1832).

New for Java? While studying *Capsicum* I received a description by Backer of a specimen from Buitenzorg. This description was insufficient for a reliable determination, but it agreed most of all with the description of Fingerhuth of the present species. However, it should be remarked that Fingerhuth mentions 7-merous flowers whilst the description by Backer is silent regarding this point.

Solanum torvum Sw., Prod. Veg. Ind. Occ. 47 (1788); Koord. et Val., Bijdr. Booms. Java IX, 266 (1903),

Solanum comitis Dun. in DC., Prod. XIII, I, 345 (1852) and

Solanum poka Dun. in Poir., Encycl. Suppl. III, 768 (1813).

Because of the absence of any original material it was not possible to me to compare these 3 species properly. It is not impossible that they are identical or only of varietal rank. The descriptions of *S. comitis* by Dunal, Backer and Van Steenis do not agree entirely and are mixed up with characters, given by Dunal for *S. poka*. Because of a decision being impossible I have kept the species separate in the Flora of Java as best I could.

Solanum cyanocarphium Bl., Bijdr. 700 (1825) and

Solanum sarmentosum Nees in Trans. Linn. Soc. XVII, 58 (1834).

Backer believed these species to be identical. Judging from the descriptions only I could not decide this question. The only difference should be the procumbent and rooting stems in *S. sarmentosum* but the material of that species in our collection certainly was not identical with *S. cyanocarphium*.

Solanum ferox L., Sp. pl. Ed. II, 267 (1762),

Solanum involucratum Bl., Bijdr. 701 (1825) and

Solanum lasiocarpum Dun., Hist. Solan. 222 (1813).

These three species are brought together in the Flora of Java under the name of *S. ferox.* The Javanese forms were distinguished as follows (the given characters, however, do not run concurrently and pass into each other; it seems advisable to consider the two last-named species as varieties of the first):

S. ferox L., s. s.: Upperside of leaves mainly clothed with equicrural stellate hairs; spines subulate.

S. involucratum Bl.: Upperside of leaves clothed mainly with stellate hairs with one erect arm, longer and stronger than the other ones, simple hairs may also occur; spines acicular. This is the main form in Java.

S. lasiocarpum Dun.: Very densely hairy, leaves moreover squamulate.

Solanum indicum L., Sp. pl. I, 187 (1753) excl. *Solanum americanum* Pluk. — *Solanum torvum* Sw.; Auct. in operis div. — *Solanum indicum* L.; Nees in Trans. Linn. Soc. XVII, 55 (1834),

Solanum torvum Sw., Prod. Veg. Ind. Occ. 47 (1788); Koord. et Val., Bijdr. Booms. Java IX, 266 (1903) — *Solanum americanum* Pluk., Alm. 350, t. 225, f. 6; L., l. c., in syn. — *Solanum indicum* L., l. c., exclus. descrip. Fl. Zeyl., Hort. Cliff., Roy Lugdb., Robert ic., Dill. Elth. and

Solanum junghuhnii Miq., Fl. Ind. Bat. II, II, 649 (1857) —? *Solanum graciliflorum* Dun. ex Poir., Encycl. Suppl. III, 763 (1813).

These three species are, by different authors, combined and identified in different manners. They suffer from an entanglement which I cannot clear away satisfactorily owing to the absence of types.

The upshot of my study of literature is as follows: Linnaeus mentions in Sp. pl. I, 187 *S. indicum* and cites four descriptions, all primarily based on the picture of Dillenius (Hort. Elth. 362, t. 270, f. 349), cited by Linnaeus, a picture and description of Burman (Thes. Zeyl. 220, t. 102) and the picture and description of Plukenett (Alm. 350, t. 225, f. 6), the last author describing an American form.

Later on it was stated by Swartz (l. c.) that this basal material was heterogeneous, the American form being quite another plant, and he separated it as *S. torvum* Sw., giving an adequate description and, moreover, the differences with *S. indicum* L., based on Dillenius and Burman. It is difficult to ascertain whether Swartz was right; picture and description of Plukenett do not form a criterion. But Swartz was one of the few, perhaps the only one, who examined the Herbarium of Linnaeus concerning this question. I take the opinion of Swartz for granted.

This mixture of descriptions, given by Linnaeus, has caused confusion. Apparently subsequent authors did not clearly understand the conception of Swartz (see the remarks of Nees under *S. indicum* and *S. torvum,* l. c.); they often classed the true *indicum* under the name of *torvum.* Finally, it was not exactly known what *indicum* L. actually was. Nees redescribed this species, based on a study of literature and some plant specimens of Wallich (l. c.). Later botanical authors cited it as *S. indicum* Nees, perhaps thinking that this was the original form and that *indicum* L. was identical with *torvum* Sw.

It is obvious that the name *indicum* L. has to be maintained, based on Dillenius and Burman and of course on the Herbarium of Linnaeus. *S. indicum* Nees most probably is identical with *S. indicum* L.

Finally the question remained: how to name the Javanese material. For this purpose I studied British-Indian material of *S. indicum* L. and American material of *S. torvum* Sw. and could state a remarkable difference, agreeing with that mentioned by Swartz. Next, sorting the Javanese material on the basis thus obtained, I found as the main form *S. torvum*. The remaining material appeared to differ from *S. indicum* and was determined as *S. junghuhnii* Miq.

Clearly these 3 species are not identical. They can be distinguished as follows (all this applying to the available material):

1. Inflorescences unbranched; upperside of leaves with spines 2
   Inflorescences branched, unarmed; upperside of leaves and calyx without spines. **S. torvum** Sw. (America, Continental Asia, Java).
2. Inflorescences and calyx spinous. . **S. indicum** L. (America, Continental Asia).
   Inflorescences and calyx unarmed . . . . . **S. junghuhnii** Miq. (Java).

From this short survey it seems to appear that *S. junghuhnii* is a local form of *indicum* and *torvum* a pantropical one.

Dunal mentions for Java also *S. graciliflorum* Dun., based on a collection of Leschenault in Herb. Paris. I was not able to study this species but got the strong impression that it is a form of *S. junghuhnii* Miq.

Solanum grandiflorum R. et P., Fl. Per. II, 35, t. 168 (1799); Koord. et Val., Bijdr. Booms. Java IX, 261 (1903) — *Solanum wrightii* Benth., Fl. Hongk. 243 (1861).

In Java *S. grandiflorum* has often been wrongly named *S. macranthum* Dun. These species, however, are quite different. Of *S. macranthum* I did not find any Javanese materials. Bruggeman, however, gives in his Ind. Tuinboek 264, f. 269 (1938) a description under the name of *macranthum* which, though too incomplete to be of evident value, may indeed apply to this species. These two species differ as follows: *S. macranthum* is far more densely spinous (though unarmed forms may occur); it has leaves woolly on both sides and tapering into the petiole, anthers hairy on one side and a pistillum clothed with simple hairs.

Solanum macrocarpum L., Mant. II, 205 (1771).

In this species the flowers change from the lower to the upper part of the inflorescence in form and sex but, as far as I could state, these two changes do not run concurrently.

Solanum mauritianum Scop., Delic. Insub. III, 16 (1786—'88) — *Solanum auriculatum* Ait., Hort. Kew. Ed. I, I, 246 (1789); Dun. in DC., Prod. XIII, 253 (1852) — *Solanum verbascifolium* L.; Koord. et Val., Bijdr. Booms. Java IX, 264 (1903) exclus. syn., except *Solanum auriculatum* Ait. and

Solanum verbascifolium L., Sp. pl. 184 (1753).

Dunal mentions *mauritianum* as a variety of *auriculatum* adding: "auriculis nullis". When this should be true *S. mauritianum* would not be identical with *S. auriculatum* but with *S. verbascifolium* L. However, Dunal misunderstood the text of Scopoli where the latter exposes the difference of his species with *S. verbascifolium*. *S. mauritianum* does have pseudo-stipules.

For the rest *verbascifolium* and *mauritianum* are very closely related indeed. The former occasionally has also pseudo-stipules at the base of the petiole but in this case these leaflets are more alike the other leaves, more conspicuously petiolate and neither reflexed into the leaf axil nor nearly conduplicate.

Solanum melongena L., Sp. pl., 186 (1753).

Dunal subdivided this species into many other ones (whilst he allowed the name *S. melongena* L. to disappear, reducing it as a synonym to *S. esculentum* Dun.). These species have been brought together again under *S. melongena* by other authors. In the Flora of Java I have acted likewise, also because I had no occasion to study all these separate species. I could only examine *S. pseudo-undatum* Bl., *S. ovigerum* Dun., *S. trongum* Poir. and *S. undatum* Lmk. all of which I referred to *S. melongena* L.

Solanum nigrum L., Sp. pl. 186 (1753).

Just as with the preceding species I have brought together under this name numerous species which had been separated in the course of time. After due examination I have united with *S. nigrum*: *S. anacamptocarpum* Dun., *S. alpinum* Zoll., *S. viscidissimum* Zoll., *S. uliginosum* Bl., *S. rhinozerothis* Bl., *S. judaicum* Bess., *S. rumphii* Dun., *S. bromoense* Kuntze (an obscure species, said to be 3 m high), *S. villosum* Lmk. (this species is kept separate in Europe but in Java it seems to be connected with the *nigrum*-group by numerous intermediate forms), *S. nigrum* L., var. *uniflorum* Miq. (a peculiar form, remarkable by its deviating habitus consisting in a rich, rosette-like ramification immediately above the ground) and *S. nodiflorum* Jacq.

The last-named species was, until now, identified with *S. nigrum* but according to very recent genetical examinations (oral information) these species differ. Literature on this subject was not yet available. I was not able to discover any morphological difference.

Solanum seaforthianum Andr., Bot. Rep. t. 504 (1797—1804).

In the descriptions a much smaller number of leaflets and simple upper leaves are mentioned, characters which are not found in the Javanese specimens. In a MS. by Van Steenis it is mentioned that, according to Bitter, in Java this species only occurs in the var. *disjunctum* O. E. Schultze. This variety may have more leaflets but I could not trace its original description.

Solanum trilobatum L., Sp. pl. 188 (1753); Burm., Fl. Ind. 57 (1768).

This species is mentioned by Burman with the addition: "D. Pryon, a quo saepius ex Java missum". I have not any evidence of it really occurring in Java but I have introduced it in our Flora to be quite on the safe side.

Solanum tjamaoel Hort.; Van Steenis. MS., nomen provis.

Van Steenis writes: "A species resembling this one (viz. *S. quitoënse* Lmk., after the description of which that of *S. tjamaoel* follows) was imported at Paroengkoeda (Salak) ca. 25 years ago, it has similar fruits as the preceding species (viz. *S. quitoënse*) but differs by the numerous short patent straight spines mainly on the twigs, whilst the upperside of leaves is densely clothed with fine stellate hairs. This species bears the probable wrong name "*tjamaoel*" ". I did not see this species myself.

Solanum superficiens Adelb., nov. spec. — *Planta* inermis glabra. *Caulis* basin versus subteres vel obtusangulus, apicem versus valde angulo-

sus. *Folia* versus ramulorum apices fere alternantia, simplicia, saepe bina (tunc in eodem jugo valde inaequalia), plerumque lanceolata, interdum oblonga et obovata, basi anguste cuneata, acuta, in petiolum decurrentia, obtusa, acuta vel obtusiuscule vel acute acuminata, integra, herbacea (in typo subcrassiora), nervis majoribus applanatis carnosis et nervis tenuibus impressis (characteribus nervorum in typo minus conspicuis), 4—22 cm longa, 2—8½ cm lata; petiolus carnosus, applanatus (in typo minus), ½—4 cm longus. *Inflorescentiae* cincinniformes, interdum semel bifurcatae, in axillis vel prope axillas jugorum foliorum, multi (usque ad 30)-florae, subsessiles, compactae, 1½—2½ cm longae; pedicelli angulati, sursum sensim incrassati, 6—10 mm longi. *Calyx* cupuliformis, in margine superiore obtuse 5-angulatus, sub fructu laeviter 5-lobatus (lobi late rotundati), margine interdum brevissime ciliatus, ceterum glaber, carnosus, ca. 2 mm longus. *Corolla* alte 5-partita, laciniis lanceolatis, acutis, apice cucullatis brevissime pilosis, in utroque latere membrano munitis, in alabastro valvatis, 5—6 mm longis; tubus perbrevis. *Stamina* 5, faucibus inserta; filamenta perbrevia; antherae apicem versus sensim dilatatae, basi saepe cordatae, apice dehiscentes poris lateralibus postea basin versus in rimam elongatis, glabrae, 2½—3 mm longae. *Ovarium* 2-loculare, multiovulatum, glaber; stylus apice incurvatis, glaber, 4—5 mm; stigma haud dilatatum. *Bacca* globosa, glabra, calyce accreto suffulta, polysperma, 6—9 mm in diametro; semina obovoideo-reniformia, applanata, margine incrassato, 3—4½ mm in diametro.

Java: W. Java, Priangan, Kartamana-estate, ca. 1600 m alt.: *J. J. Smith 641* (in bud and fr. on 20-IX-1911): type in Herb. Lugd. Bat.; Mount Papandajan (fl.): in Herb. Lugd. Bat. sub *no. 908, 245—262* (distributed as *S. blumei*); *Junghuhn* (fr.): in Herb. Lugd. Bat., *Plantae Junghuhnianae ineditae n. 404* (distributed as *S. blumei* Nees, forma *grandifolia* Miq.); sine loco (in bud): in Herb. Lugd. Bat. sub *no. 908, 245—256* (distributed as *S. blumei*).

Sumatra: *Korthals* (in bud): in Herb. Lugd. Bat. sub *no. 908, 245—1275* (distributed as *S. spec.*).

The angles of the calyx coincide with the ends of the nerves and are more or less thickened, nevertheless, the species does not belong to the genus *Lycianthes* in which the calyx-teeth are inserted just below the edge of the calyx. In the fruiting calyx of *S. superficiens* the difference with *Lycianthes* is more conspicuous.

Lycianthes levis (Dun.) Bitt. in Abh. Nat. Ver. Bremen XXIV, 484 (1920) — ? *Lycianthes subtruncata* (Wall.) Bitt., l. c. 478.

Cestrum elegans Schlecht. in Linnaea XIX, 261 (1847) — *Meyenia purpurea* Heynh. ex Kew Index II, 222 (1895), (errore relata ad Heynh., Nom. II, 404, 1840).

The name *purpurea* has no priority because that name of Heynh. does not occur in the place cited by the Kew Index and is not to be found.

Cestrum calycinum H., B. et K., Nov. Gen. et Spec. pl. III, 45 (1818), folio ed. — *Cestrum calycinum* Willd. in Roem et Schult., Syst. veget. IV, 808 (1819).

Judging from the dates Humboldt, Bonpland and Kunth are the legitimate authors. Besides, on page 352 (l. c.), which dates from 1820 (see Bull. Torr. Bot. Club. 29, 583—598, 1902) they accuse Willdenow of irregularities, such as the describing of wellknown species as new ones and they say on page 355 (l. c.): "*C. calycinum* Willd., l. c. p. 808 est nostrum p. 45".

Cestrum parqui l'Hér., Stirp. Nov. 73 (1784—'85); Francey in Candollea VII, 38 (1936).

The form with dark violet or dark red flowers and longer stalked, ovate-oblong leaves with a rounded base, originally separated as *C. foetidissimum* Jacq., var. *pallidissimum* Dun., is considered by Backer a separate species but it is united by Francey with *C. parqui* because of the characters passing into each other. As far as I could ascertain, the forms are actually different but the difference is so slight that only the creation of a var. *pallidissimum* of *C. parqui* is justifiable. Especially the form with dark red flowers points to a hybrid or intermediate form, also on account of still other characters.

Brunfelsia uniflora (Pohl) D. Don in Edinb. N. Phil. Journ. (1829) 85 — *Franciscea uniflora* Pohl, Pl. Bras. Ic. I, 2, t. 1 (1827) — *Franciscea hopeana* Hook. in Curt. Bot. Mag., t. 2829 (1828) — *Brunfelsia hopeana* Benth. in DC., Prod. X, 200 (1846).

The species is rather variable, especially in the length of the corolla-tube and in the shape of the leaves. Both characters led Hooker to describe *Fr. hopeana* as different from *Fr. uniflora* Pohl. Bentham, however, united the two species under the name of *Br. hopeana* and declared to have seen the two different leaf-forms on a same plant. According to my observations intermediate forms exist. Hooker ascribes the more obovate leaves to *uniflora* but Pohl neither mentions nor figures such leaves. Again, according to Hooker the obovate leaves would go with the short corolla-tube but I saw obovate leaves combined with long corolla-tubes. All this indeed speaks for the identity of both species, in which case the valid name is the one mentioned above.

Schwenckia americana L., Gen. Ed. VI, 567 (1764).

The occurrence in Java seems questionable. In the Herbarium of the Wageningen Agricultural College there occurs a specimen of Molhuysen from Besoeki (E.-Java) which appeared to be *Schwenckia americana* L. The genus is indigenous in America and Africa which is no unsurmountable objection. But Molhuysen asserted to have found in the region mentioned several species (of different families) which are indigenous in the said countries and which were met with nowhere else in Java and never before nor after him. All things considered, it is highly impossible that in Java these plants were really collected in a wild state.

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** = nov. spec.; * = nov. comb.; synonyms in italics.

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